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CTO

THE MAGAZINE FOR INFORMATION EXECUTIVES

Cedric and JoAnn Popp hope their son,
a computer science major, brings his IT
knowledge back to the farm

ALSO INSIDE

Building A
Winning Team
With Free Agents

PAGE 32

Lean Acres

Can IT help save
the farm?

PAGE 46

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Features

32 Smells Like Team Spirit

THE NEW WORKFORCE More and more, companies need to blend in-house staff with outside contractors. Here's what to do when part of your team doesn't really feel like part of the team.

By Lynda Radosevich

46 Lean Acres

COVER STORY: MANAGING CHANGE

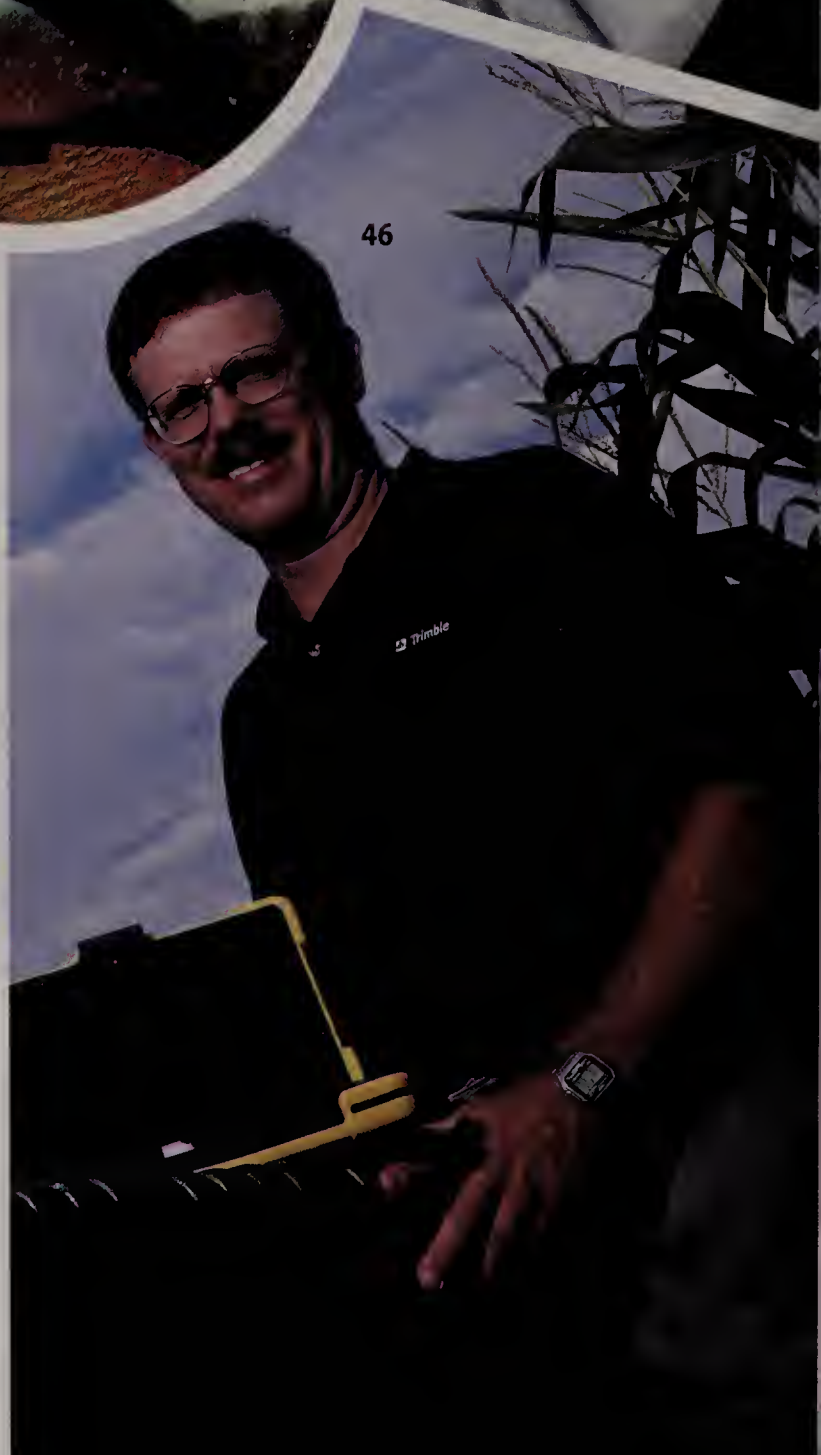
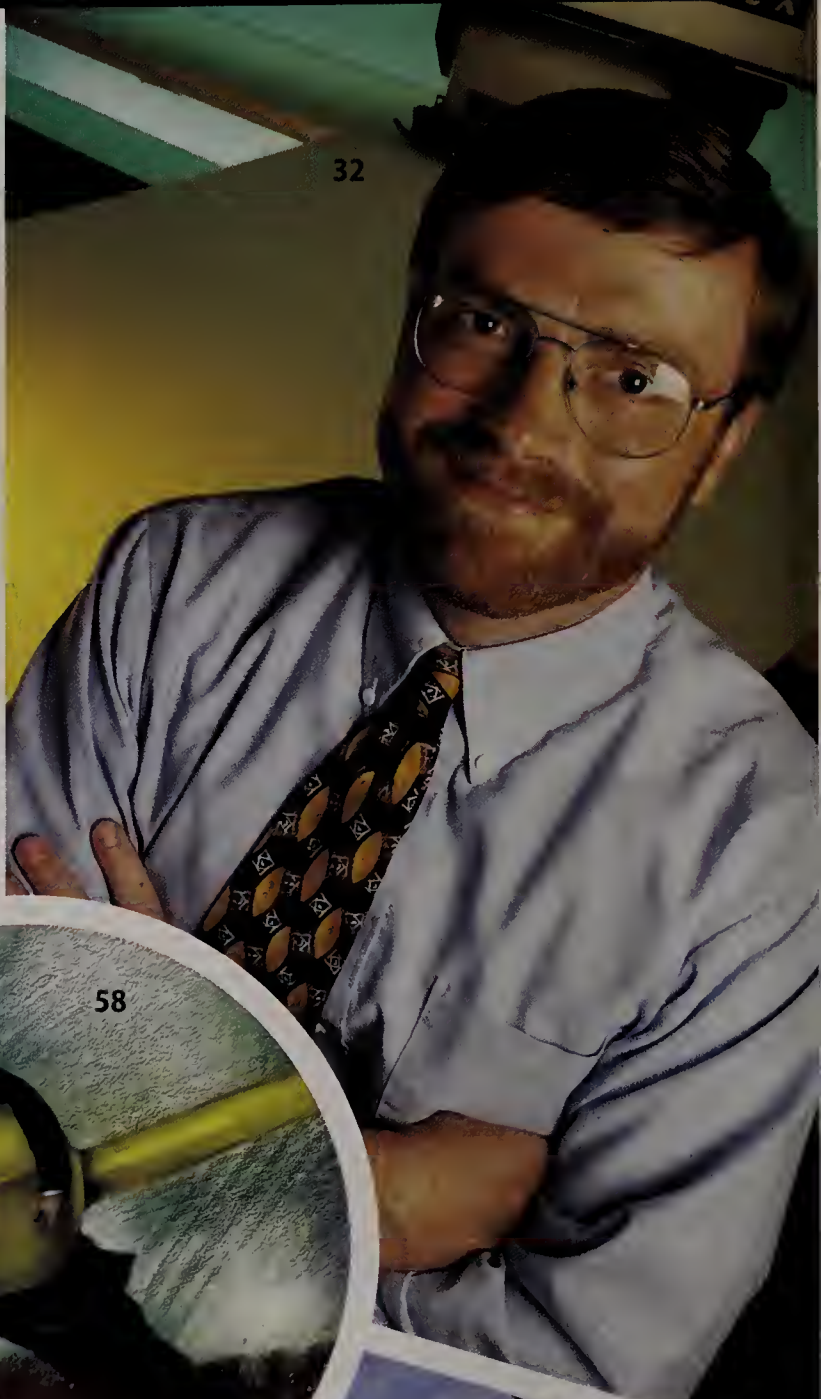
Comes a time when every commercial farmer has to ask himself a personal and philosophical question: Am I a tiller of the soil or a CIO? *By David Pearson*

58 Power Play

I.S. STAFFING CRISIS

In the face of crisis, schools must pave the way to common ground for business and education.

By Tom Field



ON THE COVER

A season of bad droughts kept Texas farmer Cedric Popp from buying as much technology for the family farm as he wanted.

Cover photo by Pam Francis

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Columns

28 Let's Get Personal

THINK TANK You've spent your career organizing your company's information. When will you get around to organizing your own? *By Tom Davenport*

66 Investigating Infrastructure

YEAR 2000 CHALLENGE Many Y2K projects are ignoring crucial external dependencies like power and telecommunications. *By Scott Kirsner*

70 In Search of Multimedia

EMERGING TECHNOLOGY As more corporate information is stored as audio and video files, users want more immediate access to it. New indexing tools tackle the problem. *By Kimberly Patch and Eric Smalley*
Finding Fiends • Managing the channel • Outlook inoculation • Mobile development tools • Tracking performance

80 The Metropolitan Museum of Art's Arthur Tisi

SHOP TALK The CIO of The Met discusses creating a Web presence. *By Megan Santosus*

In Every Issue

10 In Box

Letter from the editor, reader feedback and how to reach us • On our Web site

14 Publisher's Note

18 Trendlines

Baby Boom • Babes in PC Land • The (Call) Waiting Game • Test Patterns • Wiring Up • Get Your CFO to Explain This

78 Index



Inside Section 2

COVER STORY: PRIVACY What's the best way to build consumer confidence in your use of customer information?

STRATEGIC PARTNERSHIPS TV is marrying the Web for two reasons.

ACADEMIC INTRANETS At the venerable Harvard Business School, the Web is now at the heart of the curriculum. Corporate America, take note.

NETREPRENEURS BizRate asks consumers to tell it everything.

THE MAIN ATTRACTION The best measures for tracking your Web site's performance begin where the server log ends.

GRAY MATTERS The debate about UCC 2B is kicking up dust.

CUSTOMER INTERFACE People want real information, fast.

POWER SOURCE An online catalog is only as good as its design.

BY REDESIGN NASDAQ'S redesign answers a need for speed and easier information access.



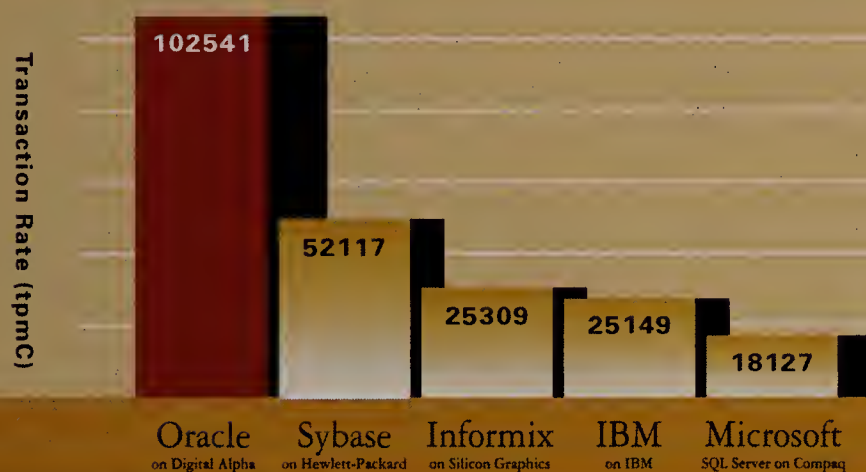
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LETTER FROM THE EDITOR, READER FEEDBACK
AND HOW TO REACH US

Every once in a while, I am struck anew by the almost absurd difficulty of the CIO job. This issue, instead of writing my regular column, I've asked CIO Editorial Director Lew McCreary to share with you his "Top 10 Reasons Why You Could Never Pay Me Enough to Be a CIO."

—Abbie Lundberg,
Editor in Chief



TOP 10 REASONS

Why You Could Never Pay Me Enough to Be a CIO

10. You're at home on a Sunday afternoon and you think of something important you don't want to forget. You call your office to leave yourself a voice mail message, and a strange voice answers your phone and says, "Andersen Consulting...."
9. You look up in the middle of your weekly year 2000 remediation task force meeting and notice that most of the seats around the table are occupied by lawyers.
8. Your HR rep proposes leafleting Fenway Park during a Red Sox game as a way to stimulate applications for open programmer slots.
7. Surprisingly, you agree to this tactic.
6. Your SAP implementation effort is into its 23rd month and you've still only deployed the financials. The project's budget ticker looks like the national debt clock, and there's literally no end in sight.
5. Every senior executive in your company thinks IS is a wholly owned subsidiary of his or her function. And if your behavior and performance fail to affirm that view, they begin to plot your overthrow.
4. The U.S. Immigration and Naturalization Service recently raided your business. Apparently the INS considers it unseemly that you are housing 17 Bengali C++ programmers in the IS group's lunchroom.
3. You're supposed to be your company's reigning expert in a wide variety of technologies that change so quickly that even the people who make them don't know what the state of the art is from minute to minute.
2. You are served with a subpoena to testify in a class-action lawsuit against your company for failing to properly safeguard sensitive customer data. Corporate counsel informs you that you could be held personally liable if the plaintiffs win.
1. The CEO recently played golf with Tom Peters and is after you to start hiring people with criminal records and histories of psychiatric hospitalization. He keeps saying things like "Weird is good" and "Weirdness is creative." You vow to work on both your golf game and your résumé. You begin to envy people with long histories of psychiatric hospitalization.

Editorial Director Lew McCreary can be reached at mccreary@cio.com.



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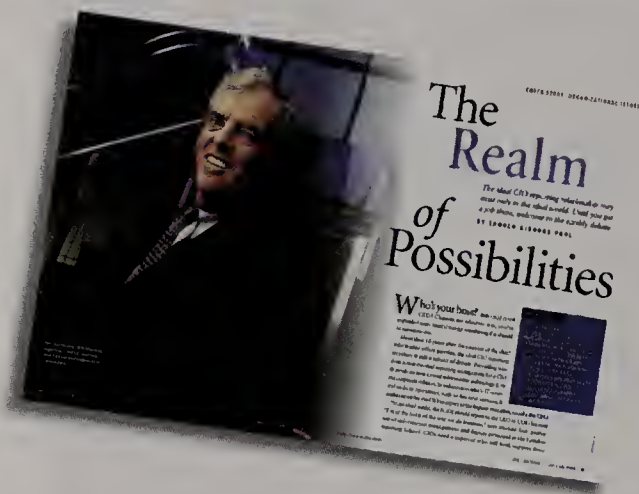
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In Box

REPORT ON REPORTING

Thanks for a great and thoughtful article concerning the influence of CIOs in organizations and the link to their reporting relationship ["The Realm of



Possibilities," CIO Section 1, July 15, 1998]. It isn't at all about title and ego; it's about truly linking IT to the business and making the most of opportunities and investments. One can do that only if the IT role is viewed within the organization as being on par with other mission-critical business functions.

Sue Kozik

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The writer is an editorial advisor to CIO.

INTEGRATING ERP

I enjoyed reading John Edwards' overview on the new EIA marketplace ["Expanding the Boundaries of ERP," CIO Section 1, July 1, 1998]. With

approximately \$24 billion spent annually on achieving interoperability between applications, there is much money to be saved through better integration practices and tools.

It was good to read Edwards' assessment that cross-application integration is no magical off-the-shelf "componentization" plug-and-play product. Achieving interoperability between disparate applications is a specialty that requires a clear understanding of the enterprise's business processes, the systems environment and each of the proprietary cross-applications. Triggered by a timed event, a user request or business-process-generated stimulus, a uniquely designed integration solution will automatically acquire data in one or more applications, apply business rule logic and deliver data to receiving applications in their native structure.

The "magic" of enterprise application integration happens only through a three-way mixture of a well-designed and maintained integration engine; well-defined application-specific systems rules and organizational-specific business rules; and a knowledgeable integration consultant.

For end users, the bottom line is this: Applications change. Business needs change. Integration solutions must be flexible and vendor-independent enough to incorporate these future software changes quickly and easily.

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CORRECTION

In the Web Business 50/50 issue (CIO Section 2, July 1, 1998), we inaccurately described Communications Data Services Inc.'s Web site. The description should have read as follows:

Offering customized fulfillment services for publishers and direct marketers, CDS manages 100 million customer files for 370 magazines. The company handles many of its 7 million annual customer service inquiries through a Web-based product that allows subscribers to access their own records, providing substantial savings.

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Publisher's Note



The fashion/retail industry

has figured it out: Just as you stock your closets with the latest "in" styles, the industry changes them. Everyone gawks at the new look and says "you will never catch me in that" but eventually even the most stubborn consumers buy.

Some say the technology business is a lot like the fashion business. Just as you get your company up and running on a "new" operating system or application, a newer one comes along with bells and whistles your company doesn't need. But eventually you buy, whether you need it or not. Everyone wants to be part of the "in" crowd.

Later this month, as your network managers and network administrators travel to Atlanta for the Fall Network+Interop trade show, give them this shopping assignment: Come back with as much information about extensible markup language (XML) as you can fit into your showfloor bags.

XML 1.0 was released in December 1997 by the World Wide Web Consortium (W3C), the same group that is overseeing the development of hypertext markup language (HTML). The W3C is headed by Tim Berners-Lee, founder of the World Wide Web, and jointly hosted by MIT and institutions in France and Japan. Its approximately 300 sponsoring members include Netscape Communications Corp. and Microsoft Corp., which plan to build future versions of their browsers on the foundation of XML.

I can hear CIOs collectively sighing, "Why do I need XML?" The answer is best summed up with two words: content and context.

Here's a simple example. I want to buy a beach chair. I go on my favorite search engine, type in the words "beach chair" and receive thousands of content-based results ranging from companies actually manufacturing beach chairs to a Beach family relative who is chair of the local school committee.

Using tagging technology, an XML search for "beach chair" would deliver results more focused on companies actually making beach chairs. XML technology holds the promise to make customer information searches of your site more relevant.

And relevancy is the bridge to increased sales on the Web. XML technology is definitely an electronic commerce fashion accessory you need. Make room for it now. You do not want to be competitively behind the technological curve on this wave.

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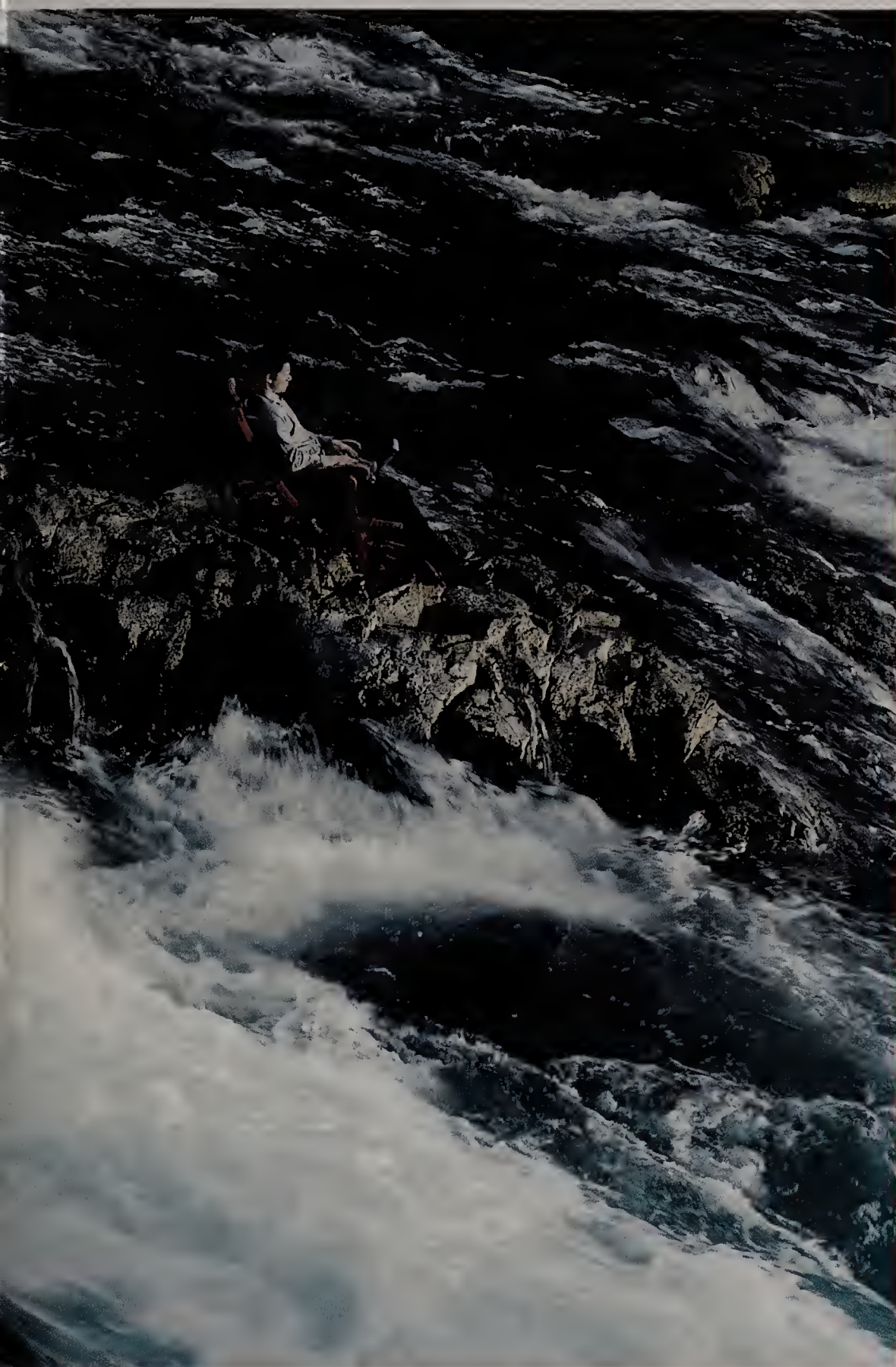
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Trendlines

NEWS, INSIGHT, HUMOR, REVIEWS

Edited by Katherine Noyes

Baby Boom

KIDDIE SOFTWARE When computer technology began to appear in educational settings, it's a pretty safe bet that few observers—not even the most hard-core technophiles—predicted it would go this far. But here we have it: lapware. Today, we live in a world in which there is software designed specifically for babies.

What on earth could a baby do with software, you ask? Well, visions of drink-powered keyboards come to mind. But the makers of several new products have other ideas. Knowledge Adventure Inc., for example, recently released *JumpStart Baby*, a multimedia software program designed to offer children ages 9 to 24 months “a delightful introduc-

tion to the family computer, helping stimulate their natural curiosity and imagination.” Designed to be used by baby and parent together (hence the term lapware), *JumpStart Baby* offers babies an interactive combination of activities, animation and sounds. Guided by Teddy, an onscreen teddy bear, youngsters can choose from among eight activities represented on a colorful mobile above Teddy's crib: Connect-the-Stars, Puzzle Time, Picture Fun, Where's Teddy?, Dress Teddy, Down on the Farm, Color Train and Let's Make Music. Young users need have no keyboard or mouse skills; any keyboard touch or mouse-click does the job. Best of all, *JumpStart*



Baby includes tips for parents on related activities that they can share with their child away from the computer. Available for both Windows and Macintosh systems, *JumpStart Baby* is priced at about \$30. For more infor-

Babes in PC Land

KIDDIE COMPUTER If you're the parent of a small child, you want to give your youngster the best possible start in life. You read Shakespeare to him. You play nothing but Mozart. No ordinary preschool for your little tyke: you've got him enrolled in the Hathaway-Fitzgibbons-Rockefeller-Crane Prep School for Toddlers. But is it enough? Sure, your 4-year-old can recite the Greek alphabet, but can he find his way around a PC?

Unless you've been brave enough to let Junior at the family computer (see “Baby Boom,” above), chances are he can't. But never fear: A new kid-friendly computer due this fall from IBM Corp. and Rubbermaid Inc.'s Little Tikes division is designed to give preschoolers the early exposure

to PCs some say they desperately need.

The unit, which resembles a desk, combines IBM technology with a durable furniture design from Little Tikes and is engineered to withstand the zeal of kids ages 3 to 7. It includes a network-ready Pentium computer, Edmark Corp. educational software, multimedia features, an internal CD-ROM drive, a 14-inch color monitor and integrated speakers. Its bench seats two children, and the desk is proportioned so that the monitor is at a child's eye level. Large, brightly colored keys on the easy-to-clean “membrane” keyboard are easy for small fingers to use. And to keep budding young technicians away from the internal workings, the unit features a sturdy housing with locking cabinet doors.

The price—\$2,399—may put the Young Explorer out of reach for some settings. But if you're worried about Junior's future competitiveness in the workforce, you may want to make sure the Hathaway-Fitzgibbons gets one. ■

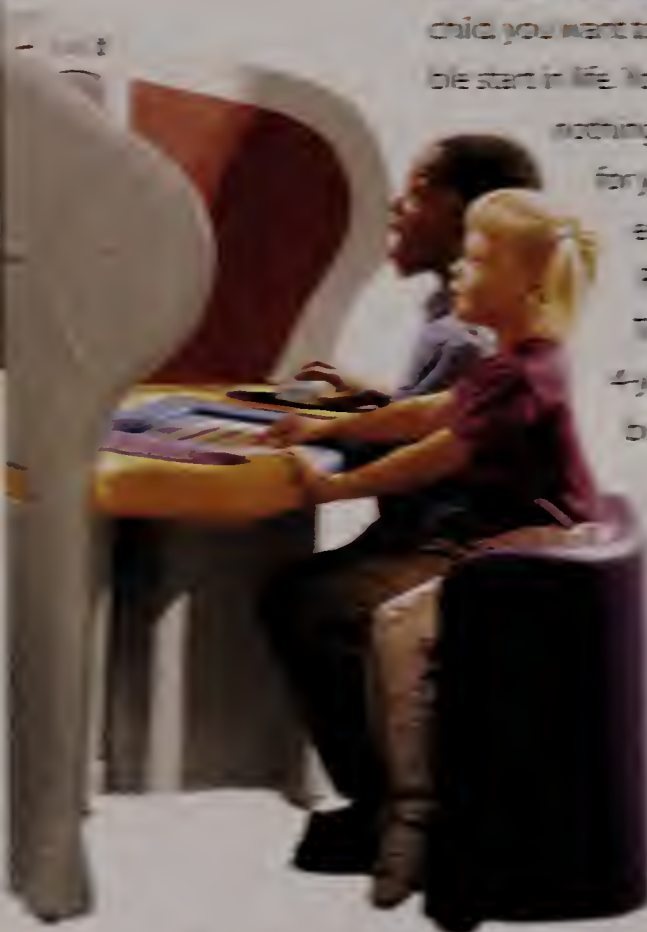


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Trendlines

mation, call Knowledge Adventure in Glendale, Calif., at 800 542-4240 or visit www.knowledgeadventure.com.

Another entrant into the lapware arena is BowWow House, which recently rolled out BabyWow, an "intelligence development tool" for children ages 9 months to 3 years. Unlike JumpStart Baby, BabyWow eschews animations and drawings in favor of realism: The software features more than 250 images and 2,000 words in 8 languages and is packed with rich photographs of real-life sights.

"[BabyWow] allows the child to be exposed to things that very few American children get to be exposed to at such an early age," says Tony Fernandes, founder and CEO of BowWow House. "BabyWow is not about games; it's about stimulation." The software is priced at \$34.99 and is available for Macs or PCs. For more information, call BowWow House in San Jose, Calif., at 888 899-0798 or visit www.babywow.com.

Kid Stuff Top software titles for kids under 5 ring up big sales			
RANK	TITLE	PUBLISHER	TOTAL DOLLARS
1	Fisher Price Ready For School Toddler	Cendant Software	\$2.07M
2	Sesame Street Toddler Deluxe	Learning Co.	\$2.19M
3	Sesame Street Elmo's Preschool	Learning Co.	\$1.72M
4	JumpStart Preschool	Cendant Software	\$2.20M
5	Reader Rabbit Preschool	Learning Co.	\$1.95M
6	Reader Rabbit Toddler	Learning Co.	\$1.92M
7	Sesame Street Elmo's Preschool Deluxe	Learning Co.	\$1.5M
8	Fisher Price Ready For School Preschool	Cendant Software	\$1.24M
9	JumpStart Toddlers	Cendant Software	\$1.63M
10	Fisher Price ABC	Cendant Software	\$484K

The makers of products like these tend to cite research on the importance of early stimulation and parental interaction for babies' brain development and socialization. And parents of kids ages 5 and younger are apparently buying in (see "Kid Stuff," this page). But is the computer the best way to achieve these ends? Not necessarily.

"I think it's a really bad thing to slap [kids] in front of a computer

screen at a very young age," Clifford Nass, a professor at Stanford University who specializes in human-computer interaction, recently told *The New York Times*. Young children learn best when they play with real objects like puzzles and teddy bears and with adults or other children, Nass explains; such contact provides social context and tactile experience crucial to early development.

—Katherine Noyes

The (Call) Waiting Game

INTERNET CALL WAITING You're at home. You've been on the Internet for more than an hour now, and you're beginning to wonder if anyone might be trying to call you. Should you shut down and kill your productivity? Or should you keep right on working—and wondering if some friend, colleague or loved one is cursing your name and shouting, "Get off the phone!" into a receiver that's been barking a busy signal for what seems like forever?

Until recently, you've had only one choice if you could stand the guilt no longer: Spring for standard call waiting and accept that as long as it's enabled, you'd lose your Net connection every time a call came through. There is, however, another

alternative. Lucent Technologies Inc. of Murray Hill, N.J., has developed an intelligent network software solution that allows consumers to receive pop-up call-waiting messages right on their computer screens while in the midst of an



Internet session. When a call comes in, you can either ignore it or route it to voice mail without losing your connection. Accepting the call will still kill your Net connection, at least for now; but in the future, voice-over-Internet technology will allow you to keep the connection alive and take a phone call over the same line, Lucent officials say.

Internet Call Waiting is available to local telephone service providers, which can then market it to their customers. For more information, visit www.lucent.com or call 888 4-LUCENT. ■

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Test Patterns

SKILLS TESTING When it's time to recruit new employees, human resources representatives are trained to screen job candidates based on résumés and interviews. When the positions that need filling are in IS, however, another key part of candidates' qualifications are often computer skills. Unfortunately, HR generalists don't always have the detailed knowledge necessary to effectively screen applicants for those skills. That's when Know It All Inc.'s Prove It computer-skills testing software can help.

Know It All's product line offers a series of tests that measure proficiency in a variety of computer-related skills. More than 100 tests are available and can measure general clerical skills such as typing and data entry, computer user skills for such programs as Microsoft Excel and Word, and programming skills in such languages as C, Cobol and Unix.



"Many of our customers come to us because they're growing so quickly," says Jackie Hoffman, director of marketing for Philadelphia-based Know It All. "Computer-based testing products are fast, easily accessible and can really help [you] avoid hiring mistakes. Even if you

Findings Insurance Online

Wiring Up

When it comes to innovating use of the Internet as a business tool, insurance agencies haven't exactly staked out a spot at the head of the class. But a new survey shows they're experimenting—and its authors predict that it's just a matter of time before these forays lay the groundwork for a new insurance sales channel.

Ivans Inc., an insurance and health-care technology-services company in Greenwich, Conn., polled 535 independent insurance agents in the United States and found, for example, that 95 percent are communicating electronically with the carriers whose policies they sell. Meanwhile, 72 percent either currently maintain a presence on the World Wide Web or will do so within a year.

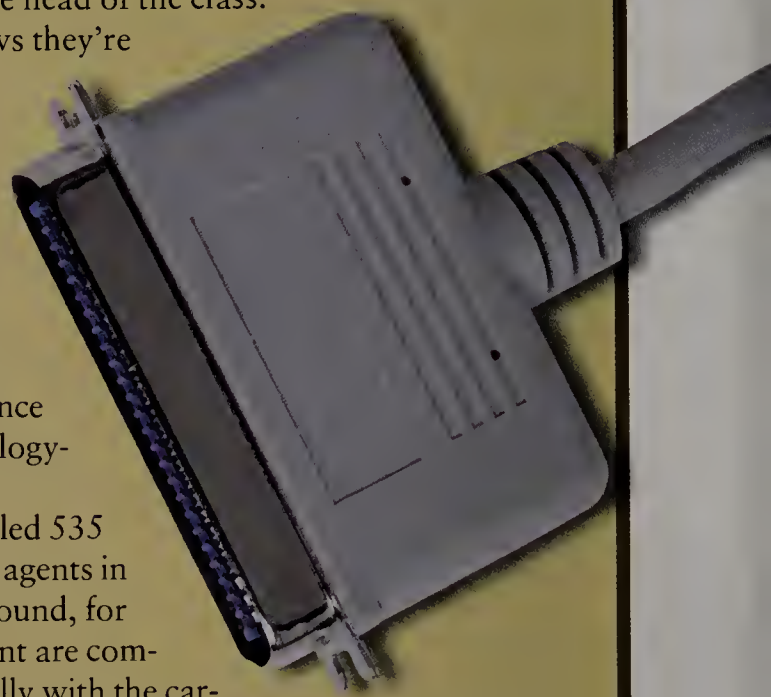
While those numbers alone may not signal the advent of the online insurance era, they do confirm that insurance agencies, long sluggish as one of the slowest businesses to adopt IT solutions, are making serious headway now. And, says Ivans spokesman Jim Kalach, the survey shows a new eagerness to try selling policies online. "Some agents [still] view the Internet as a threat, but the majority sees possibilities for marketing and selling to large groups," he says.

Indeed, the survey found that 60 percent of respondents are interested in selling insurance policies over the Internet, compared with only 27 percent who said they are not. A full 77 percent of the agents surveyed said they already have Internet access with one or more service providers; 13 percent plan to obtain access, and only 7 percent have no such plans. Eighty-nine percent have local area networks installed, compared with only 11 percent who do not.

Regarding the Web, 39 percent of respondents said their agencies currently have their own Web sites, 33 percent plan to launch one within a year, and only 24 percent have no Web plans. Among those with Web access, 66 percent typically use it for information gathering, 17 percent use it for marketing, 12 percent use it for generating leads, and 17 percent use it for other purposes.

Agents who aren't doing anything with technology "probably aren't going to be in the insurance agency business much longer," says Kalach; they're either approaching retirement or getting out of the business for some other reason.

For more on insurance and technology, go to www.ivans.com.
—David Pearson





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Trendlines

decide to hire a person who is less than perfect for the job, at least the assessments enable you to identify the areas of training a candidate will need after hiring," she says.

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Internet-based system. Both prod-

ucts require candidates to complete simulations and real-life tasks. Results are immediate, so there's no delay in candidate evaluation. Prices for the LAN-based system

range from \$149 for one test to \$3,999 for a complete package. The one-time setup fee for the Internet-based system costs \$99; each test taken costs \$25. Your company can also buy a one-month subscription for the Internet-based system for \$499 or a one-year subscription for \$3,588.

For more information, call 800 935-6694 or visit www.knowitallinc.com. ■

Words of Wisdom

"Success for the CIO depends on **adaptability** and the ability to deal with **ambiguity**."

—Barbra Cooper, group vice president and CIO of Toyota Motor Sales, USA Inc., speaking in June at the Project Management Leadership Conference in San Francisco

Y2K COUNTDOWN

Get Your CFO to Explain This

14 MONTHS & COUNTING

WHILE YOU'RE WORRYING ABOUT HOW to pay for your remediation costs, the accounting department is puzzling over what may be conflicting rules for dealing with them on the books. For those of you whose knowledge of accounting goes no further than "debits on the left, credits on the right," we'll go slowly.

In 1996 a subcommittee of the Financial Accounting Standards Board (FASB), known as the Emerging Issues Task Force, issued a simple directive: The costs associated with Y2K remediation need to be expensed as incurred. (Expensed means the cost is written off immediately, while capitalized means the cost is written off on a percentage basis over a period of time and so makes a softer hit on your bottom line.) If, on the other hand, you purchase new applications to replace those that aren't compliant, those purchases need to be capitalized.

But wait, there's more. To complicate the topic, the American Institute of Certified Public Accountants (AICPA) has recently developed what it calls Statement of Position (SOP) 98.1, which lays out three phases for tracking software costs: planning (which must be expensed), the design-code-build-install segment (which must be capitalized as an asset) and maintenance (which must be expensed). Whereas the FASB was dealing strictly with Y2K, the AICPA is targeting software development in general. And in AICPA's scheme, software upgrades fall into the second phase and so need to be capitalized.

According to Dan Noll, the Manhattan, N.Y.-based AICPA's technical manager for accounting standards, his group previously offered no guidance on accounting for software costs in external reports. The deadline for adopting SOP 98.1 is Dec. 15 of this year. And the AICPA is influential in the financial community. "If you don't follow the rule," says Noll, "you can't borrow money."

But now here's the big question: What if you're using one of the many conversion tools being touted for Y2K? Does that count as an upgrade (which should be capitalized according to AICPA rules) or Y2K remediation (which should be expensed according to FASB rules)?

Joe Porfeli, CEO of Revive Technologies Inc., a Carnegie, Pa., vendor of such automated conversion tools, insists that his tools slip through a loophole in the FASB rules because they're not specifically built for remediation; they simply convert data from one platform to another. As a result, he says, the cost of the tools can be capitalized. Of course, as part of the conversion process, you can also identify Y2K glitches and fix them. "We take your old software and convert it. You can convert an IDMS database to DB2. It functions exactly the same way, but it's easier to maintain," Porfeli says. "We fix Y2K in the process. It's like getting Y2K for free."

OK, but will FASB accept that argument? Sigh. If there's any comfort to be drawn from this, it's that technology isn't the only industry that suffers from competing standards.

—Howard Baldwin

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Let's Get Personal

You've spent your career organizing your company's information. When will you get around to organizing your own?

YOU'RE PROBABLY NOT THINKING much about your post-Y2K agenda yet. But surely by February or March 2000, most of the problems will have been solved and global economic catastrophe averted. What will be the primary concern of IS then?

You could install Windows 99 (late as usual) on everybody's PCs, figure out what to do with all that great enterprise resource planning (ERP) data you've got or start planning for the year 10000. But let me recommend something completely different.

Since the day the Univac started passing around electrons, we have dealt with information management as an organizational issue, not a personal one. IT planners and data architects have focused on what information the organization needs. Reporting systems have addressed the critical success factors of the business as a whole. When individuals were addressed at all in information management, they were encouraged or threatened about adhering to organizational standards of hardware, software or data nomenclature.

What we haven't done is address how individuals manage their personal information. I'd argue that today our organizational information systems are infinitely better than our personal systems. Why do I think that? For starters, when I'm speaking to large audiences, I routinely ask people to raise their hands if they feel they have an effective personal information environment. Out of thou-

sands of possible hand-raisers, I've gotten only two. Ever.

Second, I've always subscribed to the highly sophisticated research methodology that recommends analyzing your own behavior in the absence of any better source. And I am a walking personal information management disaster. My most effective repositories are my pockets; but once a note, a business card or even a check leaves them, they often vanish for good. I get a lot of e-mail, and I often find that I answer the most trivial ones first—just because they're easy—while those requiring a bit of thought scroll off the screen and may never get a response.

I do have a Palm-Pilot, a couple of laptops and a few desktop machines, so I have no lack of personal horsepower. However, all that technology has compounded the problem. An address, to-do item or file I need could be on any one of those devices.

As for my desks and filing cabinets—let's just say that I took great comfort in a recent news item that said

companies where employee desks are messy have better financial performance than those companies where employees have neatnik desks.

The simple answer to my problem is that I have underinvested in my personal information environment. I should probably contemplate what my information needs are, organize a better paper- and hard-drive-filing structure, create some e-mail folders, study how to do better Web searches, get a business card scanner and spend my airplane time keying phone numbers into my cellular phone list.

I have three problems with these virtuous activities, however. One, I find such tasks exceedingly boring.

Two, I'm not convinced they would make me more productive; I spend my airplane time writing things like this column, for example. Three, some of these things I just don't know how to do. Like many an executive I've consulted, I don't know what my information needs are or how to decide whether I'm better off reading *The Wall Street Journal* on the Web or in print (although I know I prefer the comfort of ink on cellulose).

Somebody needs to figure out this stuff. Providing access to information, long the mission of IS groups, is not the problem anymore. We all have more information than time, and we're trying to manage more and more information—more, in fact, than some smaller data centers contained



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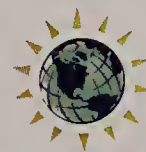
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Think Tank

20 years ago—at an individual level. No matter how good an organization's information is, if individuals can't find it, store it and use it, then it's of little value. Personal information effectiveness has become the limiting factor in business information management for most organizations.

Assuming you wanted to give your

and was almost forced to retire when Apple Computer Inc. discontinued the product), the paper junkie and the hybrid use-the-appropriate-medium-for-the-task-at-hand wise guy.

■ Find experts in certain aspects of personal information management—the best information searchers, for example, are clearly librarians; the best

wrong). Perhaps you could lobby your favorite college or university into offering such a course—ideally to first-year students.

But before we start getting better at personal information management, it may be useful to try to find out just how bad the situation is today. After all, if I'm the only info-deviant in town

Personal information effectiveness has become the limiting factor in business information management for most organizations.

own personal information management system a shot, how would you go about it? Hey, if I knew, I'd write a bestseller on the topic. I don't think anyone really knows, but I will suggest a few starting points.

■ First, start by translating classic time management and personal organization principles into our digital environment. For example, the idea that every piece of information should be touched only once may be of some use. ■ Consult a college textbook. The only one I know of that addresses this particular area is *Personal Productivity with Information Technology* (McGraw-Hill,

stomers, records managers—and start to pull together a body of integrated knowledge.

■ Hire a consultant to shadow key executives for a day and get a better understanding of what information and knowledge they use (and, perhaps more important, what they don't use that they should).

Once you have some aspect of the problem figured out, start offering courses to your employees. I don't know of any IS organization that currently offers a single bit of instruction on approaches to managing personal information. I say currently because the CIO several generations back at the former Bank of Boston offered a course in listening skills; that was at least somewhat related to personal information management. I've applied the "raise your hand if you're doing this" test here as well: The one person I found who offered instruction on effective Web searching turned out to be a librarian.

Universities and even elementary and secondary schools should teach students how to better manage their personal information, but they don't. After all, what knowledge is more valuable than how to find, organize and learn from the world's information? Maybe if schools did teach this, we'd remember a little more of what we learned in those institutions.

In 21 years of schooling, I don't remember any formal instruction on how to find, manage and apply information except for one professor's confident injunction to use the card catalog before approaching a reference librarian (and I think he was probably

and there's no real problem, you can forget you ever read this. And if you were to undertake some initiative in personal information, you could then measure your progress against an initial benchmark.

If you wanted to do this formally, you could survey a sample of employees to learn just how overloaded, disorganized and info-stressed they feel. Or run a time study; watch some typical employees and managers for a day and measure how much time they spend looking for information. You could even measure the time it takes on average to respond to an e-mail; my guess is that it's rising in most organizations.

If you want to benchmark informally, send some of your colleagues various e-mail and paper memos and then ask them a month later about some arcane piece of information in the memos. After they stop cursing, ask them how long it took them to find the information.

Of course, you have to be careful in getting personal with information in your company. The last thing to do is to start policing hard drives and e-mail in boxes. The idea is to offer education, insight and very gentle persuasion. Carrots almost always work better than sticks, particularly when you're dealing with personal stuff. **CIO**

Thomas H. Davenport is a professor of management information systems at Boston University School of Management and director of the Andersen Consulting Institute for Strategic Change. He welcomes reader comments at thomas.h.davenport@ac.com.

**We all have
more information than
time, and we're trying to
manage more and more
information at an
individual level.**

1996) by Gordon Bitter Davis and J. David Naumann. I personally wasn't swayed into adopting its gospel of personal information planning and investment, but a more disciplined reader might be.

■ Look for some exemplars in your organization—real information heat-seekers who are high-performers as well—and study how they do it. You'll need several different models: the fully automated nerd (like the guy I knew who ran his entire life from his Newton

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Smells Like

Team piral

More and more, companies need to blend in-house staff with outside contractors. Here's what to do when part of your team doesn't really feel like part of the team.

BY LYND A RADOSEVICH

Reader ROI

HOW DO YOU DEVELOP A CULTURE that encourages healthy teams? In this story you will learn

- ▶ How to retain and reward contract employees while keeping the core staff happy too
- ▶ Who makes up the new class of contract IT professionals
- ▶ Why the IT workforce is changing
- ▶ What the challenges are of managing a blended workforce of contract and permanent staff
- ▶ How to best meld contract and permanent staff into an effective team

Rich Walsh knows the challenges of managing a mixed team at Honeywell-Measurex.





<http://www.cio.com>

ICH WALSH HAD A PROBLEM.

RIn March 1997, Honeywell Inc. purchased Measurex, a Cupertino, Calif., company that built control systems for the paper-making industry. Honeywell then calved a portion of its industrial controls business and merged it with Measurex to create Honeywell-Measurex. To hasten the merger and grab a competitive market position, company leaders resolved to build an integrated enterprise resource planning (ERP) system based on Oracle Applications software—an undertaking that would require many bodies with ample experience.

But the new business was losing staff, including top IT talent; many of the Measurex employees left because they were nervous about how the Minneapolis-based Honeywell would manage its long-independent Silicon Valley office. And frankly, they had myriad other opportunities. In addition to needing people

PHOTO BY KENT HANSON

f flexibility

with Oracle skills, Walsh, named director of information technology at

Honeywell-Measurex, required people skilled in Internet and year 2000 technologies, both hot areas. He did not have the desired staff in-house, and he could not fill the open positions in time to complete the project.

"It's probably the most competitive job market in my career," laments Walsh, a 20-year Honeywell IT veteran.

To overcome the hiring challenge and gain needed expertise, Walsh began hiring contractors and consultants and now manages a blended team of in-house and third-party talent. But he finds that integrating a mixed workforce into a smoothly operating team isn't easy, primarily because of personal dynamics. For one thing, in-house and third-party employees may earn different wages for the same levels of work, which can create hostility.

"Sometimes there is this built-in antagonism between hired guns and staff. And sometimes there is a misper-

Ted Peck likes the independence and flexibility he gains from being an independent contractor.

ception about how much money that goes to a contractor ends up in their pockets," Walsh says. He's still trying to find the right tools to create the sense of teamwork that is essential to a project's success. But so far he's been able to smooth wrinkles by using good people-management techniques such as helping full-time staff develop the business and leadership skills that they wouldn't get as contractors and by including contractors in reward and recognition programs

typically reserved for permanent staff.

As the blended workforce becomes commonplace, more and more CIOs are sharing Walsh's predicament. As CIOs require increasingly specialized technologists, a growing number of the most highly sought-after professionals are going independent or working for agencies that represent their interests in much the same way a sports agency represents an athlete's interests.

Labor experts point to several macro-

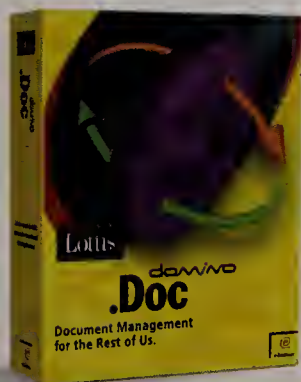
Technology managers who aren't managing a mix of independent and permanent staff will become increasingly rare.

PHOTO BY MARK WILSON

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dynamics that are contributing to the changing of the workforce in general and the IT workforce in particular. Downsizing-induced layoffs in the early 1990s dissolved the guaranteed bonds between employer and employee. As companies became leaner, they relied more heavily on brainpower, information and communications to help them compete. Many workers with special skills, no longer bound by company fealty, found they could make more money and advance more quickly by joining consulting firms or striking out on their own. This is especially true in the IT services sector, which is growing at 16 percent per year, according to Forrester Research Inc. in Cambridge, Mass. The IT consultant population reached approximately 1.25 million in 1997 and will be more than 2 million by 2000, according to Advanced Technology Staffing Inc., an IT staffing firm in Redwood Shores, Calif.

As it becomes more difficult to hire sufficient full-time staff and as the supply of third-party workers increases, technology managers who aren't managing a mix of independent contractors, consultants and permanent staff on crucial projects will become increasingly rare. But creating an effective team out of a mixed workforce requires careful management. Contractors on mixed teams are motivated differently than their permanent counterparts; in general, they tend to be more independent, more specialized and less concerned with the host company's business and politics than full-time staff, yet they share the need to be a part of the team's social fabric, training and reward structure. And core staff, working with independent coworkers who may seem to make more money than they do, need special rewards, opportunities and encouragement to remain on board and enthusiastic.

Although there aren't hard and fast rules for successfully leading a blended workforce, CIOs who are doing so find the same broad techniques work well for them, namely understanding workers' different motivations, creating incentives that properly reward teamwork, creating an inclusive culture and, as is necessary in every discipline, communicating effectively.

TO UNDERSTAND WHAT motivates independent contractors, consider Ted Peck, a quintessential member of the new class of contract IT professionals. An MIT graduate with a degree in mathematics, the 39-year-old freelance software developer has 16 years of experience and extensive knowledge of application development. After leaving MIT, he worked first for a large software company and then for a smaller one. In 1988 he joined several college friends at an inter-

face software tools company, Oakand Group. After the company was sold in 1991, he stayed with it for another year, then began consulting for former clients. He incorporated as Nivel Partners Inc. in Cambridge, Mass., in 1997, but has been independent ever since 1992, working primarily with and for previous acquaintances.

Working as an independent contractor gives Peck more of what he wants out of his professional life, like flexibility with his time. "I can take a morning off if I want," says Peck. "And it's not that I couldn't do that as a full-time em-

Northwest Natural's Chuck Beyer worked closely with his project manager to stamp out destructive attitudes.

Communication

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ployee for someone else, but I have more psychological flexibility with my time. I know I'm not billing for the hour, so I don't have to feel guilty about not working," he says.

There are other benefits to contracting as well. Peck estimates he takes roughly six weeks of vacation time per year and, billing at \$90 per hour, he would earn roughly double the salary he would earn as a full-time company employee if he didn't take as much vacation time.

"There are a lot of intangible benefits of being a full-time employee, like getting paid while reading the newspapers. But I try to calculate the actual value of health benefits, retirement benefits and the like, and those benefits seem to be a drop in the bucket compared with the salary difference," Peck says.

Peck fits the description of the advanced-skill IT consultant to a tee. In a survey of 1,700 such consultants, Advanced Technology Staffing found them to be primarily between 36 and 50 years old, with an average of 17 years of IT training and education honed to maintain specialized skills. More than 30 percent are college graduates, 61 percent have worked more than 15 years in IT and nearly one-third have 10 years of consulting experience. They combine telecommuting with onsite work and take six to eight weeks vacation per year. They tend to be male (80 percent) and married with children, and they're motivated by the ability to control their careers, increased earning potential and professional development.

"These people are not between jobs," says Dominique Black, chairman and CEO of Advanced Technology Staffing. "So the issue becomes, what do you do to retain them? The first thing is you offer them strong rates and challenging work, and you accommodate some quality of life issues. Most of these

folks are making over \$120,000 a year, but they want 8 to 10 weeks off a year, and they're able to do it."

The trouble is, blending these highly skilled free agents with a permanent IT staff can cause social friction that hampers teamwork and increases a project's development costs and time. Among the leading problems is that the contractors may not be attuned to corporate culture and may lack a view of the bigger picture of the company. Also, contractors' and consultants' direct pay is likely to be

higher than staff pay and, if a company uses contractors to supply all the hot new skills, in-house staff can become cynical and depressed. On the other side, contractors can feel left out of pertinent management information, ostracized from meetings, excluded from special awards programs and unwelcome at bonding functions such as company parties.

One company found that the development of such divisiveness can be deadly to an IT project.

Late in 1992 Northwest Natural Gas

Co. in Portland, Ore., set out to build a new customer information system. The system was designed on a three-tiered, client/server model and used new object-oriented technologies in which Northwest Natural's IT department had no experience. The vast majority of expertise had to come from outside contractors. IBM Corp. won the project management bid and supplied its own people, and both IBM and Northwest Natural hired independent contractors to help install a packaged utility industry system.

The project ran into trouble almost immediately. Because it involved many vendors and some immature technology, both IBM and Northwest Natural Gas spent too much time solving technology problems instead of business ones, which quickly consumed the budget.

Chuck Beyer, CIO of Northwest Natural, arrived at the company in 1995 as the director of its Customer Information System Project. "It was the 'we/they' attitude," says Beyer. "The Northwest Natural people had all these requirements, maybe a lot of them not very realistic. The vendor had a fixed price contract, so they had to say, 'No you can't have that,' or 'No, it's not in the specs,'" he says. "Nobody made much

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An eight-step process for achieving a blended workforce

- 1 Establish clear boundaries for skill requirements and scope of involvement for the assignment workforce.
- 2 Establish human resources policies and practices to support the blended workforce strategy.
- 3 Institute parallel selection criteria for core and assignment employees.
- 4 Establish an integrated communications program for core and assignment workforces.
- 5 Use an onsite manager from the staffing service provider to manage day-to-day employee relations, counsel and supervise the temporary workforce and conduct performance reviews.
- 6 Include temporary workers in team meetings, process improvement activities and important communication. Provide incentive bonuses to contract as well as to full-time employees.
- 7 Conduct job training for assignment employees that includes basic team skills, communication and behavior skills.
- 8 Establish specific metrics to monitor productivity and quality.

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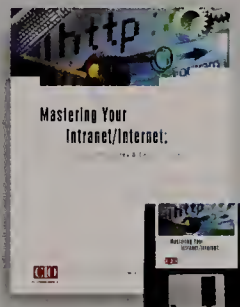
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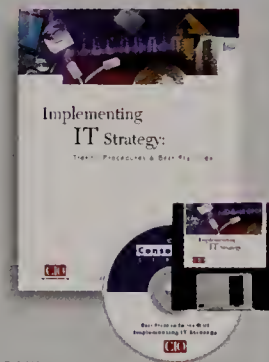


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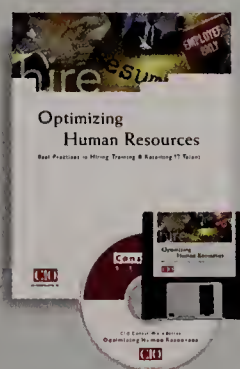


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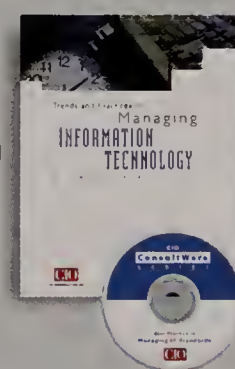


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progress until they brought in a new project manager. Once they started making progress, they began running out of money.”

Experienced managers find that the first step to eliminating such divisiveness and melding contract and permanent staff into an effective team is acknowledging the problem and clearly communicating that teamwork is an unquestionable requirement.

At Northwest Natural, Beyer worked closely with his project manager to stamp out destructive attitudes. They brought all the project personnel together onsite—users, IS staff, IBM consultants and third-party contractors—and stated that there would be no rank or privilege based on who issued peo-

John Keast encourages PG&E teams to partner on tasks and learn from each other.

ple's paychecks. In some cases, Northwest Natural staff had to report to contractors. “That was tough. This is a 139-year-old company with a close-knit culture, and to say you're reporting to a contractor, they were taken aback by that,” Beyer says.

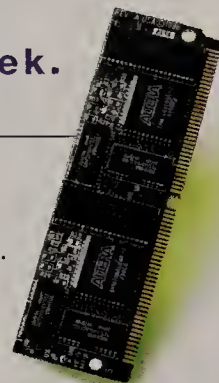
Nonetheless, the group ultimately developed its own inclusive subculture and beat the revised schedule by delivering a completed system in November 1997 rather than in January 1998. The team spirit wasn't the only success factor—Beyer also canceled the development project, found a new package and began modifications to keep costs from rising too high—but esprit de corps was essential to the project's success. “My idea of

a successful meeting is when somebody attends and says, ‘I couldn't tell who worked for whom,’” says Beyer. “That's the way it's supposed be, and that's the way it ended up,” he says contentedly.

Managers find that another way to help keep tensions down and spirits high on combined teams is by distinctly delineating contractors' and permanent staff's roles and valuing what both sides bring to the table. In many cases, full-time employees possess the broader management skills and company knowledge needed over a project's long haul, while contractors have the more specialized skills necessary for shorter duration. By shaping a project's jobs to best suit workers' strengths and abili-

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ties, managers foster cooperative rather than antagonistic spirits.

At PG&E Corp., an energy company conglomerate in San Francisco, the general model is to use internal people for direction and project management and independent resources for specific tasks. Big Five consultants fall somewhere in the middle—they provide project management and subject-area expertise. Rather than feeling threatened by the outsiders, the extra help assures internal folks that management will source the project correctly, says John Keast, PG&E's vice president and CIO. "And that's a good thing," he adds.

valuating the cultural fit is intuitive; a sneakers-and-jeans department probably won't work well with a blue suit.

When delineating workers' roles, however, managers find it's important not to sequester contract employees from permanent staff. To avoid doing so, Keast has them partner on tasks. That helps workers build a good personal rapport and encourages them to learn from each other. "If you segregate teams by putting them on different tasks, you don't get that mushing together that makes a project team successful," he says.

Perhaps a stronger stimulus to blended team success is equitable financial treatment. On projects that require staff to work long hours, salaried internal employees or fixed-priced consultants don't automatically get paid for their extra work as do contractors who are paid by the hour. Or, in some cases, permanent staff may feel a stronger motivation to work extra hard in hopes of promotion or because they have ownership interest via stock options, while contractors don't have forces motivating them. To balance the financial incentives, some CIOs are setting up bonus plans for both permanent and contract staff to meet tight project deadlines. In addition, some CIOs give spot bonuses

to individuals for exceptional performance, without distinguishing between hired guns and staff.

In a previous position, Walsh surprised and gratified contractors by handing out ad hoc bonuses when they went above and beyond the call of duty. "It's good human psychology. People like to be recognized for doing something good," he says.

In a similar financial vein, managers find that a key to avoiding insider/outsider antagonism is explaining to permanent employees why contractors in the same positions tend to earn higher hourly wages. Forrester Research calculates that when a staff person earns \$33 per hour and a contractor earns \$70 per

hour for the same job, the actual cost to the company is \$63 and \$74 per hour, respectively, which isn't such a huge gulf. Included in the full-time staff costs are roughly \$30 per hour in training, paid time off, bonuses, taxes, insurance and recruiting.

Good managers emphasize other benefits for employees as well, including stability, stock options and potential advancement. "If a person is interested in broader skills as opposed to an exclusively technical focus, we offer something of appeal to them. They can be something other than the world's greatest database administrator with a gypsy life," says Honeywell's Walsh.

While management training can be a special benefit for full-time staff, experts say a key component of building successful teams is providing project-related training to everybody. For instance, although contractors may not require technical training, they should be included in all project-related business process and professional development training. "Make sure that you identify that group as the same team by offering the same training and requiring the same prerequisites," says Marc J. Wallace Jr., a partner with the Center

for Workforce Effectiveness, a human resources consulting firm in Northbrook, Ill., and co-author of *Work and Rewards in the Virtual Workplace: A New Deal for Organizations and Employees* (Amacom, 1998). Likewise, Wallace advises setting up similar work conditions for all types of employees. If contractors can telecommute, let staff people telecommute. "That helps to avoid the creation of second-class citizens," he says.

Finally, technology managers say that judging project members' social skills is as important as reviewing their technical skills when developing a close-knit crew. Some companies subject contractors to a similar, if not as vigorous, interview process as they do payroll staff. Evaluating the cultural fit is an intuitive process; if a company's IS department has a sneakers-and-jeans demeanor, hiring blue-suit consultants probably won't work very

well. In addition, managers tend to form ongoing relationships with workforce suppliers such as agencies and with individuals. "The key is to become more of a relationship manager," Black says.

Unfortunately, workforce experts give most IT departments low marks in relationship management. "If I look at our own client base, I would give most companies a 'C' to 'B' on these things. It's new, so there aren't a lot of best practices that have developed yet," says Wallace.

But CIOs who are having success melding contractors, consultants and staff say many of these techniques boil down to using the common sense they develop from long experience. The trick is applying the old rules of good management—awareness, communication, rewards and incentives—to the new, blended workforce.

"At the end of the day, a team's dynamics are critical to its success. Focusing management time on making sure teams work well together is just something you learn over the years," says Keast. **CIO**

Lynda Radosevich, a senior editor at Infoworld, can be reached via e-mail at lynda_radosevich@infoworld.com.



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THE WORLD'S FOOD GROWERS ARE snapping up IT tools faster than you can say "business fertilizer." Here's how commercial food producers use IT to manage an ancient endeavor that's one of the modern world's riskiest businesses.



Comes a time when every commercial farmer has to ask himself a personal and philosophical question: Am I a tiller of the soil or a CIO?

BY DAVID PEARSON

NEVER MORE THAN ONE POOR HARVEST AWAY from ruin, the folks who feed the world face each day at the mercy of forces beyond their control. Like the local pest population. The world economy. And the weather.

This summer saw a surge in foreclosures and auctions as Texas endured one of the worst droughts in its history, and the Midwest slogged through a grain glut that drove prices way below production costs just as the strapped Asian countries began shopping elsewhere. And U.S. farmers moved one season closer to 2002, when government subsidies will dry up, thanks to Freedom to Farm, a landmark farm-deregulation bill passed in 1996 that will give farmers fixed but declining payments over a seven-year period.

All this has come at a time in American agricultural history that strongly favors big megafarms over traditional, and smaller, family farms. The total number of U.S. farms has dropped from more than 3 million in the mid-1960s to just over 2 million, yet average farm size has steadily increased. You might say that farming, in more ways than one, has become a matter of grow or die.

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COVER STORY: MANAGING CHANGE

Or that the challenges have changed. Where once the spoils went to the fastest feet in the field, they now go to the most skillful risk managers in the business—the growers who set their sights on long-range survival and then invest in the best means to get there from here.

Naturally, that means technology. The labs of “ag-chemical” companies are turning out everything from genetically engineered seeds to ingenious insecticides. And IT is separating those with a future in commercial farming from those just growing a few things on the side.

“I really think that, in time, farming will just be information management,” says Bill Holmes, who tends corn, wheat and milo on 3,000 acres in Oran, Mo.

“IT still can’t change the weather, but it can help you be more sure that certain things are or are not going to happen at certain times and in certain ways, and then you’ve got an angle there to exploit,” says Stephen Phillips, vice president of Computer Sciences Corp.’s Strategic Consulting Unit in London.

By guiding all the activities that affect production—planting, irrigating, fertilizing and harvesting in the right amount at the right time—initiatives like computerized field mapping enable producers to quickly change plans as the weather shifts or new opportunities open up in the market.

Where the traditionalist sees tractors, pigs and hay bales—the same familiar assets looked upon by parents and grandparents in years past—today’s tech-savvy farmer sees so many sources of data. That’s a wise view to those who like what they’re doing and want to keep doing it, for in the competitive world of modern farming, those who lack the ability to manage information from many and varied sources hazard falling behind the better-equipped competition. And that will mean losing farming’s most precious fringe benefit—control of one’s own little world.

Making Hay

In the United States, farmers’ attitudes toward information technology vary from one region to the next, with California and the Midwest generally leading the way into the agri-information age, the Western plains states bringing up the rear and everyone else somewhere in between. And age is a pretty reliable predictor of where a farmer will stand when the subject of computers comes up at the local lunch counter. Those with five years or fewer until retirement are most likely to turn back techno-talkers in no uncertain terms. Folks in early- or mid-career are all ears.

Cedric Popp, 48, who grows cotton,

grain sorghum and soybean in El Campo, Texas, turns to the World Wide Web for the latest on market conditions, weather, new products and the cooperative that sells the fruits of his labor to retailers. “It’s just a world of knowledge there that’s unbelievable,” he says.

No numbers are available to quantify the number of professional farmers doing some kind of computing, but recent advances in precision, or site-specific, farming seem to have lured a sizable number into the Information Age. The idea is to analyze soil and crops in grids, sometimes as small as one square foot, and treat each one for soil quality, drainage properties and so on. The old way was to treat an entire field, no matter how expansive, as one uniform plain. (See “Precisely Right,” Page 54.)

Precision ag represents the gold standard of farming technology, but few farmers are ready to jump headlong

Age is a pretty reliable predictor of where a farmer will stand on the subject of computers.

into the world of satellites and sensors without first testing the waters of more basic computing. Many work their way up from spreadsheets and mapping programs and find increasing levels of benefit as they step up the ladder.

Popp maps fields not with data provided by satellites and automatic monitors but with records gathered by scouting the soil and manually entering data into a mapping software program. “I can go in and set up a spreadsheet and put in a lot of detail, and the computer will calculate things that are very illuminating.” He doesn’t see



a dire need for more sophisticated mapping since the land around El Campo is flat and there's little variation from one grid to the next. But he does recognize the value and plans to increase his investment in precision ag when current circumstances change. "I really wanted to do more this year, but we've had this horrible drought," he says. "There certainly won't be a surplus of cash, so I can't justify buying a lot more technology this year."

Computerization can also bring some broader business benefits, such as allowing independent farmers to persuade their offspring that the old family farm can still provide a future. "Our 18-year-old son Michael is heading off to college in the fall," says JoAnn Popp, Cedric's wife and a former math teacher who now drives a tractor on the farm. "As farm parents, you always hope they want to come back and apply their skills on the family farm. But you really can't predict four years from now." What's Michael going off to study? Computer science.

"Once you get over bein' afraid of the computer, it just flows like butter," says Tom Niewohner, a soft-spoken corn and soybean grower with 1,350 acres in Onawa, Iowa. "You've got to get over a certain point, but once you cross over that line, it just seems like there's no end to it."

Educators and professional observers say people like Niewohner, Popp and Holmes stand to thrive over the coming 10-year period. "The technology integrators tend to be much better managers," says Ryan Eby, president of the Site Specific Management Co., a farm consultancy in Goshen, Ind. "The grower himself gets to spend more time in the office, doing analysis and marketing, and he can start hiring more employees to work in the fields. Whereas the older guys, who haven't bought into the technology, are still out there in the fields working long hours."

Eby adds that IT is in its infancy on most commercial farms, but it's growing faster than hybrid corn in a greenhouse. "Over the last five years, just the innovators got involved," he says, "maybe 10 percent of all farmers. I think this year has been the first big boom for the rest of the crowd."

"Precision ag technology has finally given farmers a

Growing Pains

Points of interest along the learning curve



From a strategic planning perspective, the dynamics of technology adoption may derail the best-laid plans, according to Jess Lowenberg-DeBoer, an agricultural economist at Purdue University in West Lafayette, Ind. Based on lessons learned developing hybrid corn and motorized mechanization earlier this century, he suggests the following lessons for precision agriculture in the coming years:

- Be ahead technologically, but not too far ahead. Evidence shows that profits go to the early adopter, not necessarily to the tinkerer.
- Be prepared for bumps. Technology change is rarely smooth. Precision agriculture may have more ups and downs than most new technologies.
- Develop management expertise. That's often the most durable byproduct to grow out of experimentation with new technology. You know the hardware and software will change rapidly, so build the capacity to use whatever tools are available to manage sites.

—D. Pearson

way to use a computer for something they're interested in," says Jess Lowenberg-DeBoer, an agricultural economist at Purdue University in West Lafayette, Ind. "Before, it was just accounting, payroll and taxes, and no farmer I know wants to think about those activities any more than he has to."

Asked for evidence of the growth of IT in agriculture, Lowenberg-DeBoer estimates that last fall there were around 17,000 yield monitors in use in the United States and Canada, installed in roughly 3 percent of all combines. That number is likely to grow sharply over the next five years because many new combines are being sold ready for the equipment to be installed.

IT is in its infancy on most commercial farms, but it's growing faster than hybrid corn in a greenhouse.



Bolstering farmers' receptivity to such options is the fact that mapping software has gotten easier to use with each new release. "My suspicion is that eventually most farmers will do at least some of the mapping themselves, though they might hire a crop consultant to help them interpret what the data means," says Lowenberg-DeBoer. "There has also been quite substantial growth in companies that offer field mapping and interpretation services."

Yet a look at one of those organizations confirms the view that commercial farmers are divided over the value of IT. Gary Schneider, a former Arthur Andersen consultant who is now president of Ag Decisions Inc. of Idaho Falls, Idaho, led the creation of a nifty software package that helps growers crunch disparately drawn data so that

they can see the trade-offs facing them between profit, risk, resource use and conservation practices. In its first three quarters, the product generated only a lukewarm sales response—about 100 copies. As of press time, Schneider was about to sell his company to an industry giant with plenty of marketing muscle.

Schneider says that when he's been able to sit face to face with a prospect, he can usually close a sale. But it's not easy to get to that point. He recounts his experience at a recent trade show where one farmer after the next walked right past him and other software sellers to gather around gadgets like a sprayer that shoots beneficial insect larvae into trees to kill harmful insects.

"Farmers are just bombarded with new technology every day from all kinds of angles," says Schneider. "They're overwhelmed."

What many farmers may not yet realize, says CSC's Phillips, is the extent to which the farming landscape may

Early arrivers are, for now, holding off from asking the hard questions about ROI.

be reconfigured by some of the companies that sell them the tools of precision agriculture. "Information capabilities are allowing ag-chemicals companies, for example, to shift from protecting crops to guaranteeing yields," he says, citing a recent merger between Monsanto Co. and American Home Products Corp. to create a \$96 billion life-sciences juggernaut.

"It depends on how these consortia roll out precision ag-based capabilities," says Phillips. "Will they go and start acquiring more physical assets, or will they provide a service that they will license to farmers? If they go the latter route, then maybe there's a little more time for the small producer; maybe there's a win-win for everyone in this. Squeeze more yield per unit of land and the grower is happy; he gives a piece of the action to the service provider, so they're happy—and we're all happy because there's more food to feed the ever-growing number of mouths around the world." That would be the ideal situation, says Phillips, but it's not the most likely one. "I think greed and the passion for growth and shareholder returns will mean that if these guys [the vendor groups] see an opportunity to get in and create consolidation and take ownership of the physical assets all the way down the food chain, then we're going to see a lot more consolidation." Naturally, vendors buying farmland would mean more farmers with less control of their own destiny.

Planting Profitability

Count Tom Niewohner among the farmers who seem poised to ride out whatever change may come their way. So progressive has he been in implementing precision agriculture technologies that a few years ago other Iowa farmers began approaching him for tips. It didn't take him long to see the profit potential in this new opportunity, and today he's got 47 regular clients with his business Agri-Tech Solutions. "It's gettin' a little rough farming and helping all these people, too," he says in a soft drawl. "I'm looking at maybe bringing a couple of people on" to work the fields.

Niewohner purchased his first computer back in 1989, after two of his younger brothers returned from college warning him of things to come. He's now got "a couple each" of desktops, laptops and handhelds, plus a full complement of GPS and yield monitoring gear for the heavy equipment.

Niewohner tells his clients that they need to watch out for two things as they amble into the Information Age: One, as you get far along with the technology, you can get overloaded with too much data. "You've got to sit down and sort out what you need and don't need to know. Computers are supposed to help you,



Tom Niewohner saw the potential in precision agriculture when other Iowa farmers turned to him for tips.

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pentium® II

but you have to know how to run 'em to extract the data that you want." And two: You're going to get some ribbing. "I'm always hearing things like, 'You've got more in your tractor than I've got in my office,'" he laughs.

Sounds good-natured enough coming from him, but a neighbor of his declined to speak with CIO for that very reason. Seems some recent national publicity on the neighbor's technology investments has led to unspecified expressions of bitter resentment from area farmers who lack the means, or the vision, to keep up with technological advances.

And the early arrivers are, for the time being at least, holding off from asking hard questions about what they're getting back on their investment.

For Bill Holmes, who, like Niewohner, splits his time between farming and a technology business—he's president of Agronomy Service Bureau LLC in Oran, Mo., which sells precision ag software called AgInfo—investing in IT is a matter of managing better. And that doesn't necessarily mean producing more. "Our yields are constantly going up," he says. "But can you attribute that to precision farming? I don't think so. We also have better genetic engineering and better chemical arsenals to work with, and we're getting better at irrigation." It's very difficult to nail down the return on investment in IT, adds Holmes. "But we know that the technology provides a big efficiency boost, so it will eventually be in place just about everywhere. You have to adjust to the new reality or at some point you won't be competitive in the marketplace."

Says Texan Mike Petter, a farm-management consultant with Resource and Land Management Inc. based in Pleasanton: "Guys who are not adopting information technology may be sittin' on the fence within the next couple of years as far as whether they're viable producers or not. We're seeing a high degree of interest, but most of these folks are still in the stand-back-and-look-at-it mode. It's probably mostly a cost issue for many of them, and then there are some intrinsic things about farmers where the perspective is, 'Grandpa didn't do that, and it worked for him.'"

"But," adds Petter, "the technology really hops across the fence real quick. Once they get started using it, and the neighbors see what's going on, then it'll take off." **CIO**

Senior Writer David Pearson can be reached at dpearson@cio.com.

Precisely Right

New precision technology lets farmers conquer their fields by dividing them



The point of precision agriculture is to manage each crop-production input—seed, fertilizer, insecticide, limestone and so on—by small grids rather than uniformly across one large field.

Farmers have always wanted to handle variations in productivity within a field and maximize yields, but it's only recently, with the proliferation of new technologies, that they've been able to do so reliably. There are by now myriad precision ag tools to choose from. Among the most useful and popular:

- Global positioning systems (GPSs) use satellite data, provided by beacons attached to tractors, to precisely track equipment and map land to be planted, sprayed, tilled and harvested. It's the same basic technology used by the U.S. military for positioning armies and arsenals. Satellite data is also used to track evaporation rates.
- Yield monitors mounted on combines calculate and record a field's yield in real-time as it's being harvested. This allows farmers to project total yields long before they're completely harvested, which aids in deciding how much to store or sell.
- Sensors beneath the soil gauge mineral and nutrient content, while above-ground ones measure the light-reflectance of crops (providing early warning on diseases and matching fertilizer inputs to canopy structures).
- Variable-rate applicators use sensors to monitor the speed of the tractor and adjust the amount of fertilizer and pesticide sprayed on the soil. This ensures applying optimal amounts of the chemicals grid by grid, making for more economical use of supplies.
- Wireless weather stations feed data on wind, temperature, humidity and soil moisture to the farm computer.

Pulling all these data sources together is specialized global information system software, which allows farmers to map fields by variables in soil, moisture and productivity; this helps in planning what area needs which activity and when.

For Kent Western, who runs an 800-acre corn and soybean farm in central Illinois, a modest investment in precision agriculture has resulted in striking returns. For \$7,000, he purchased a GPS receiver, yield monitor and soil-sampling equipment; another \$3,000 bought him a new Pentium desktop computer and some mapping software. "The first year I grid-sampled, I saved \$8,000 in fertilizer," he says with obvious enthusiasm, "just by knowing where not to put fertilizer down. Turns out I had been overfertilizing many of my grids for years and hadn't known it." Western's farm is relatively small; in most cases, the initial investment in precision agriculture runs between \$15,000 and \$25,000.

—D. Pearson

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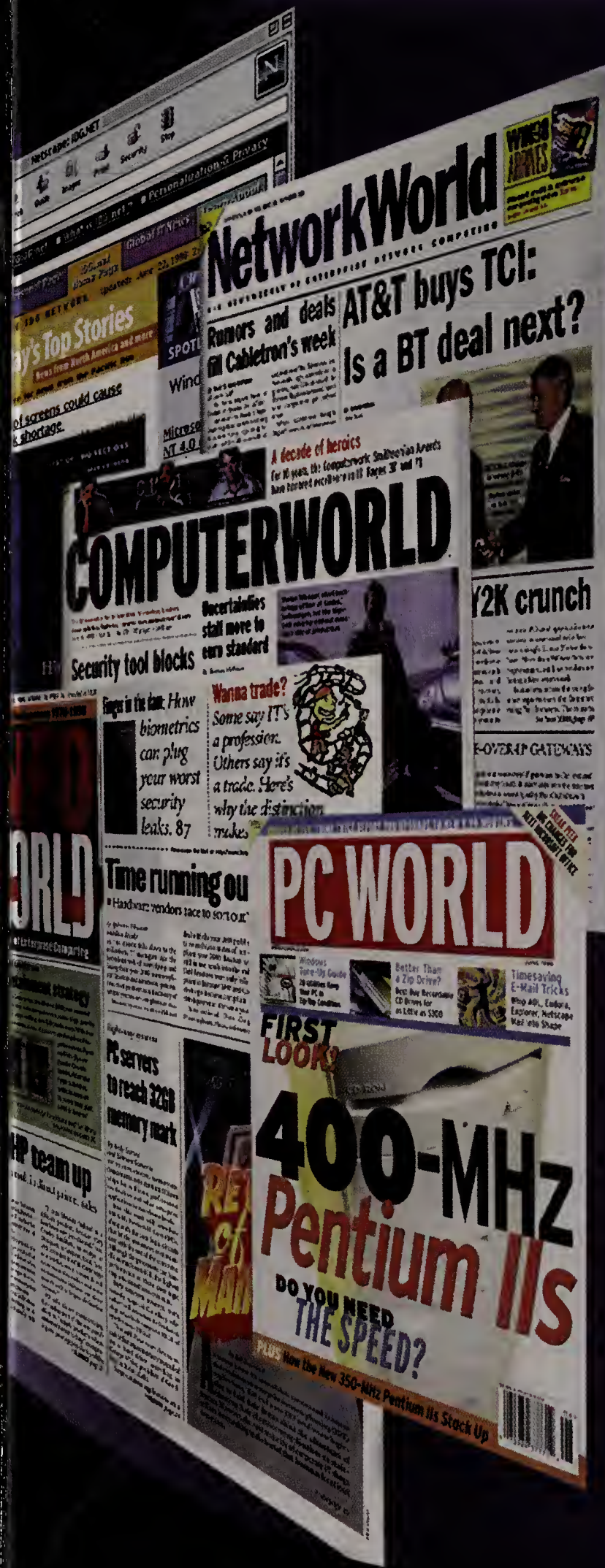
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Answers for the Information Age





Reader ROI

CIOs increasingly rely on higher education as a source of new employees and training. But to maximize the business/education relationship, some old communication barriers must fall. Read this story to see

- ▶ The risks of not reconnecting businesses and schools
- ▶ How the old barriers are being broken
- ▶ Ways IS executives can be proactive in establishing new relationships with schools

In the face of crisis, schools must
pave the way to common ground
for business and education

BY TOM FIELD

POWER play

rICHARD SKINNER HAS DEVOTED his entire life to education, but in many ways his real schooling began in the spring of 1997. That's when, as president of Clayton College & State University (CCSU), a modest school in Morrow, Ga., he toured AT&T Corp.'s network and computing services division in nearby Atlanta. There, Skinner got an earful from Network Control Manager Peter Cornell while on a fact-finding mission to determine how CCSU might help AT&T fulfill its future business needs. AT&T was being hammered by the IS staffing crisis, Cornell explained. Not only was the hot telecommunications industry spawning a host of

new jobs involving new technologies—and in a region that fancies itself a burgeoning telecom hotbed—but AT&T also had a large IS staff approaching retirement age. It would be a daunting task to find new IS workers and replace retirees in an already tight labor marketplace where AT&T's competitors faced the same challenges. "How can we help?" Skinner asked about schools in general and CCSU in particular. Cornell considered the question, then answered frankly. "I'll tell you what we need," he said, "but I don't honestly think you can provide it." You see, AT&T needed current and prospective employees to be trained in the new technologies—and quickly.

I.S. STAFFING CRISIS

To provide that training, a school would need to demonstrate uncommon flexibility, offering skills-based degree programs and technology certification courses taught at least in part by seasoned business executives both in the classroom for traditional students and in the workplace for busy professionals. And the training would have to satisfy today's business needs while still being responsive to tomorrow's changing technologies.

Yet, in Cornell's experience, schools such as CCSU offered only traditional, theory-bound undergraduate programs taught strictly by academics on campus, using tried-and-true technologies and teaching methods. Skills-based training? Most academics sniffed at the suggestion that they should rush to offer advanced training in Java, NT or any other IT skill du jour. Flexibility? At AT&T, a new idea can zip from the drawing board to the marketplace in six months; at most schools, a proposal for a new course offering can take six years to get from boardroom to classroom.

What could Skinner say? Cornell was right; schools in general, CCSU in particular, were glaringly out of sync with business needs. In no way did CCSU offer the types of training businesses such as AT&T needed to fight the skills shortage. To be truly responsive, the school would have to completely reassess how it taught technical skills.

Skinner listened appreciatively to the rest of Cornell's presentation. Then he returned to CCSU, gathered his senior staff and shared what he'd just experienced. "I think we just heard a voice we have to listen to," Skinner said. With quiet resolve every head in the room nodded.

The Disconnect

The voice Skinner heard wasn't just Peter Cornell's, and it wasn't directed solely at CCSU. Historically, business executives have pointed to a disconnect between industries' market-driven needs and higher education's ability—willingness, even—to meet those demands. And while

academia typically has embraced this disconnect as a necessary "church and state" buffer between their lofty education goals and what they consider to be fickle business whimsy, the ongoing technical skills shortage forces even skeptics to reassess higher education's role in fighting the crisis.

This business/academic disconnect was a major topic of discussion among government, industry and education officials at the National Convocation on the IT Worker Shortage, held in January at the University of California, Berkeley. There, the U.S. Department of Commerce presented its fall 1997 report, "America's New Deficit: The Shortage of Information Technology Workers," which identifies a nationwide mismatch between what the businesses want for technical skills and what the schools teach. "Graduates may be superb computer theorists," the report says, "but employers are looking for IT workers skilled in networking and distributed computer environments and large software projects, people who have real-world experience and who are capable in business and industrial settings."

The Information Technology Association of America (ITAA), an Arlington, Va.-based trade association, confirmed the report's findings with a survey of its 9,000 members, concluding that 69 percent of IT companies find that only "a few" or "some" IT job applicants have the skills the companies need. Two-thirds of the members surveyed said they believe American colleges and universities are not producing enough students with sufficient knowledge and skills in IT.

Jarred by this information, government and industry leaders emerged from the convocation with a single concern: competitiveness. These officials fear that if the nation's high-tech businesses don't get the skilled labor they need, American industry will lose its edge in the global marketplace—or be forced to move the work to foreign workers who have the necessary skills.

Skinner attended the convocation—in fact, he chaired a committee that studied the disconnect—and he detected con-

Status Quo on Staffing

CIOs see no change ahead for labor shortage

THE GOOD NEWS IS THAT THE IS STAFFING CRISIS isn't getting any worse. But the bad news is it's not getting any better either.

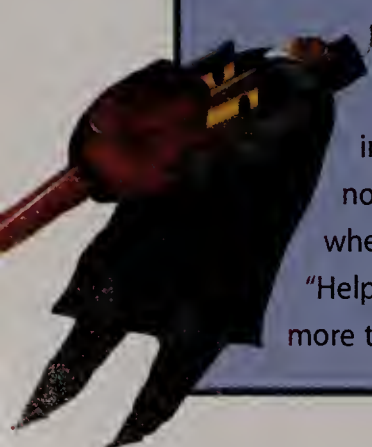
At least that's the conclusion of the latest *CIO* "IS Staffing Study," which polled IS executives about their recruiting, retention and training concerns. While the survey shows a slight increase in IS staff turnover rates—15 percent now, as opposed to 14.5 percent late last year when *CIO* conducted its first staffing study (see "Help Wanted Now," Dec. 15, 1997/Jan. 1, 1998)—more than half of the respondents say their turnover

rates have held steady so far in 1998.

CIO's findings are consistent with the state of the IS staffing crisis, says Harris Miller, president of the Information Technology Association of America (ITAA), the Arlington, Va.-based group that has lobbied hard to draw attention to the issue. Currently, the ITAA estimates that there are 346,000 vacant IT positions in the United States—not including government agencies or nonprofits.

For more information on the survey conducted by IDG Research Services Group, see www.cio.com/forums/staffing/resources.html.

—T. Field



cern among certain enlightened educators that they'll lose students and funding to other training providers if their schools aren't deemed responsive to business needs. Until now, U.S. colleges and universities have dominated their regional markets. But with the advent of Internet-enabled distance learning, a world of universities now can compete for a region's students. And increasingly, IT-intensive companies such as Motorola Inc. are establishing their own internal universities, while third-party vendors are transforming into for-profit training providers. "What happens [to traditional schools] if Microsoft or Disney decides to get into the education business?" Skinner asks. "There is a serious discussion calling into question the role of higher education. A year ago, I thought this was a [minor] issue. Now this disconnect is a serious concern."

The obvious solution to the disconnect is that businesses and schools must form better partnerships. Except it's not that simple, says Kelly H. Carnes, the U.S. Commerce Department's deputy assistant secretary for technology policy in Washington, D.C., who has been one of the government's point people on the IS staffing crisis. Schools need to listen to business insights and be prepared to completely reconfigure their delivery of skills training—to move beyond the theory-based, two- and four-year degree programs and start offering more short-term certificate courses in hot, new technologies. And the businesses not only need to invest money and other resources in the schools, they also must insist on ROI. "I see a lot of people in the corporate world making investments as a sort of philanthropic act: 'If I throw money at the schools, they'll get better,'" Carnes says. But the schools need more than money; they need input from senior business executives to help shape and teach courses, and they need internship opportunities for students and faculty alike. Put simply, Carnes says, "Industry has the ability to drive change [in education] by being a very sophisticated customer."

Since January, Carnes has toured the nation with Commerce and Department of Education officials, hosting "town meeting" forums with business and education leaders to talk about the disconnect. From these discussions, Commerce hopes to uncover some best practices for business/education partnerships to highlight in a new study scheduled for release in early 1999. So far, the early returns show that people everywhere recognize the problem, but few offer solutions. The surprising news is that the reputed leaders in technical education are, at best, followers in reconnecting with business. The real partnership activity is occurring at state and community colleges, which are seen as being closer to the businesses.

The standoffishness of the big schools can be attributed in part to denial. Some educators subscribe to the well-publicized theories of Norman Matloff, the University of California-Davis computer science professor, who says there is no staffing shortage—that the only "crisis" is that caused by the discriminatory high-tech companies that shun mid-career IT workers in favor of younger, cheaper labor.

But the more common attitude among the name schools,

Carnes says, is that the staffing crisis isn't their problem. Enrollments aren't down at Stanford and MIT, after all, and their IT graduates are still coveted by business recruiters, so why should the schools change their approach to IT training? That stance is not universal among the major schools, Carnes says, "but [the attitude] is a lot more widespread than it should be."

At Stanford, Computer Science Professor Eric Roberts doesn't deny the existence of the staffing crisis or the disconnect, but he does dispute Carnes' and other critics' notions about how schools should address the issues. "It doesn't make sense for us to train students for exactly what businesses need today; the skills will be obsolete when students graduate," Roberts says. "The university's responsibility is to produce bright, well-educated people for the long view [of IT education], who will be able to respond to business change."



Enrollments aren't down at Stanford and MIT, so why should the schools change their approach to IT training?

Currently, Stanford's Computer Forum hosts an annual meeting for educators and business leaders to discuss curriculum and research, but there is little day-to-day dialogue between the two sides about IT training, Roberts says. "I don't know whether we need more," he adds. "Whatever it is we're doing, industry seems to like it at least as well as what anyone else is doing."

If businesses really want to partner with education, Roberts says, then they should stop pilfering from the education pool and send some of their senior executives back to school to earn graduate degrees and teach undergraduate courses. "It's a question of resources," Roberts says. "This call to produce more people when we don't have the resources to do so is a little scary."

Yet at smaller schools, the more frightening prospect is what might happen to them if they don't become more responsive to business needs. Champlain College in Burlington, Vt., for example, is no Stanford University when it comes to name recognition—with 1,350 students, it isn't even the biggest college in its own hometown. But administrators there pride themselves on their business ties, so when Champlain officials saw that local businesses were being affected by the IS staffing shortage, the college responded quickly by changing its entire approach to IT training. Rather than limit offerings to IT theories, Champlain added new courses such as "Object Oriented Programming Using C++" and "Advanced RPG/400 Programming" and condensed some classes into six-week sessions that could be taught not only on demand but also onsite at local businesses. Instead of limiting its efforts to traditional classroom instruction, Champlain put 100 courses online for students to participate in at times and places of their own convenience.

I.S. STAFFING CRISIS

"We're quite willing to work with organizations and customize a program to meet their needs," says John Lavallee, Champlain's chairman of computer sciences and director of distance learning (and the school's de facto CIO). The payoff is that Champlain's programs now appeal to a broader base of students and businesses, Lavallee says. There also is the satisfaction that little Champlain College is ahead of the reconnect curve, balanced with the realization of what grim fate might have awaited if the school hadn't responded to business needs at all, or if one of Champlain's larger local rivals did so first. "If we'd stuck to our knitting, as we like to say in Vermont, we'd be in trouble today," Lavallee says.

Omaha AIMs High

Then there's Omaha.

Six years ago, business leaders in Omaha, Neb., realized they had a problem. Clearly, IT was the new engine driving economic growth, and Omaha was home to many IT-intensive businesses. But these companies were struggling to recruit and retain IT workers. Part of the problem was, well, Omaha. The city, the state and the climate just weren't as attractive to prospective employees as, say, Silicon Valley. But the greater concern was the inability of local colleges and universities to teach the skills businesses needed.

Joyce Wrenn knows what Omaha was like in the early '90s. When she first moved from Dallas six years ago to take over as CIO of Omaha-based Union Pacific Railroad Co. (UP), Wrenn tried to lead an enterprisewide thrust to client/server platforms for all new applications. But when

she approached the local schools regarding training for her staff, Wrenn was shocked. Forget client/server; these schools were still teaching Pascal and Cobol.

Yet, just as Wrenn encountered the wall, local businesses began tearing it down. In 1992, the Omaha Chamber of Commerce initiated the Applied Information Management Institute (AIM), a nonprofit corporation formed by local businesses, schools and government agencies. Funded by memberships, service fees and grants, AIM strives to ensure that the IT skills sought by the business community match those taught at local secondary and post-secondary institutions. AIM's business partners now sit on curriculum committees at the local schools; professors and students from AIM's member schools spend more time in the businesses, gaining greater practical experience; and AIM itself sponsors IT conferences and training for all participants.

In just six years, AIM has become a nationally renowned model of business/education partnership. Business leaders and academics alike laud the institute's success at bridging critical communications and skills gaps. "One of the greatest successes we've had is that we've been a neutral party," says Robert Sweeney, AIM's executive director, who has more than 30 years of experience as an educator, manager and economist. "We're not owned by any business or college, so no one questions our agenda. We've been able to get this topic [the business/education disconnect] on the agenda in the community. The rest of [our success] is just being an honest broker."

Among AIM's accomplishments:

Dismantling the Disconnect

IS executives who want to establish better links to local colleges and universities can start the process with these simple steps

Speak up

Take time to articulate your staffing and training needs—what specific IT skills are you using, and what will you need in the future? Don't let the schools guess at your requirements.

Get involved

In Omaha, Neb., some CIOs sit on the curriculum advisory boards at local colleges, while others are mentors in high schools, trying to stimulate the interest of prospective IT workers.

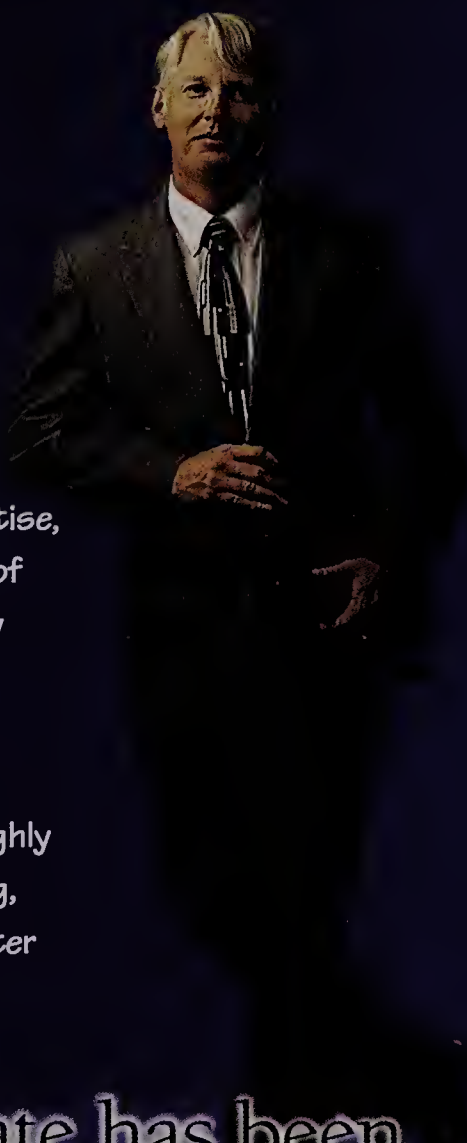
Share your resources

In Atlanta, AT&T Corp. executives teach relevant IT courses at local Clayton College & State University, using some of AT&T's own internal courseware. It's a big investment upfront, but the payback is students with practical, not just theoretical, learning experience.

Pool your efforts

Schools, like businesses, respond to critical mass. When one Omaha-based business needed client/server training, local schools didn't respond. But when two businesses combined their needs and went to all of the area schools with an RFP, one college offered a tailor-made, discounted training program. If you've got specific IT training needs, chances are your colleagues at other companies do, too. Combine your needs and approach the schools with a united front.

—T. Field



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I.S. STAFFING CRISIS

Critical mass.

Individually, Omaha's businesses had a hard time articulating and satisfying their IT training needs. AIM has given them a vehicle to present both a united front and a lucrative customer base to the schools. When UP moved its new applications to client/server, for example, First National Bank of Omaha was in the midst of a similar move. AIM brought Wrenn together with her bank counterpart and helped the two CIOs write a request for proposal detailing what skills the businesses needed for their employees and when. The RFP went out to all AIM-member colleges and universities. The winning bidder not only provided the classes UP's and First National's employees needed but did so at a reduced cost and in the businesses' own facilities.

Curriculum change.

Early on, AIM polled 68 member businesses, asking what IT skills they employ most and how well they felt the local schools taught those skills; the most desired skills were deemed to be taught worst. AIM shared this information with local colleges and universities, which responded in part with a new commitment to IT. Today, local Bellevue and Creighton Universities both have new, business-responsive IT centers, and two state schools—the Universities of Nebraska at Omaha and Lincoln—have pooled resources to open the new Peter Kiewit Institute of Information Science, Technology and Engineering, an Omaha-based school chartered to meet the needs of the IT industry. AIM members sit on curriculum committees at local universities, creating an ongoing dialogue about business needs and skills training.

Cost savings.

Individually, Omaha's businesses could spend hundreds of dollars per day on travel and tuition, sending IS staff to vendor-sponsored training. But AIM works with IT vendors and individuals from other businesses to bring the seminars to Omaha, providing members' employees with up to 300 days of skills training per year—and at a significant discount for AIM member businesses. AIM has also negotiated with four local schools to offer 10 new IT courses, with 100 seats in each class discounted for employees of member businesses (120 seats on evenings and Saturdays).

Wrenn, who chairs AIM's board of directors, says the institute's results are felt directly in businesses such as her own. "Overall, it's easier to recruit people [to Omaha]," she says. "They can get the courses they need to keep abreast and grow, and we've now got students coming out of schools we can employ more readily."

The New CCSU

In many ways, AIM was the model Skinner wanted for CCSU. Having studied AIM at length during his research for the workforce convocation, Skinner says, "I was impressed, first, that Omaha was trying to do something [about the business/education disconnect]; second, that they were able to bring business and industry together; and, third, that they'd really thought through their approach."

As Skinner and his staff applied the AIM model to CCSU, listening to the needs of local IT executives such as Cornell at AT&T, they realized that everything considered so important to education in the past—classroom face time, theory-based teaching, time-intensive degree programs—had to be reconsidered.

Earlier this year, after about nine months of development, Skinner and his team emerged with a proposal for a new, three-tiered IT program. Aimed both at traditional students and those already in the workforce, the new IT program offers skill certifications as well as associates and bachelor's degrees in specific IT competencies such as networking, system analysis and client/server integration. The courses are offered in classrooms and online, led by a mix of CCSU professors and local business professionals. And, in response to businesses' need for project management skills, CCSU's IT classes are taught in a project-centric manner. As freshmen toil on introductory course work, sophomores and juniors learn to manage single IT projects, while seniors oversee multiple projects. The IT program is structured such that students can enter—and return to—the workforce at any of the three levels, but if they choose to earn a degree, they initially have five "bachelor of IT" choices: database administration; software development; information design and production;

"Industry has the *ability* to drive change by *being* a very sophisticated customer."

—KELLY CARNES

network planning, design and management; and general IT. Wireless technology and management of information majors are being developed.

In May, Skinner brought the IT program proposal to CCSU's board of regents. Nervously, he prepared for resistance from traditionalists who might want to move more slowly—or not at all. Instead, Skinner says, the message from the regents was crystal clear: "It's about time."

CCSU's new IT program went live in August. What does CCSU need to be successful? Not the usual large sums of money upfront, Skinner says. Instead, the school needs intellectual assets—senior IT executives to teach classes, corporate courseware to augment CCSU's own teaching materials.

AT&T's Cornell has done his part. He sees that CCSU is making an effort to do what he initially said couldn't be done, so he's investing in the new IT program. AT&T has offered curriculum advice, some of its own internal training materials and even senior executives to help teach classes. In return, Cornell hopes CCSU can prepare able bodies, both now and in the future. A risk? Yes, but a necessary one given the market demand for skills, Cornell says. "This is a long-term investment," he says. "I think I'm preparing for the future of the company, when people retire and move out of the business. I'm trying to make sure we've boosted the supply of IT workers ahead of the boost in demand." **CIO**

Senior Writer Tom Field can be reached at tfield@cio.com.



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Investigating Infrastructure

Many Y2K projects are ignoring crucial external dependencies like power and telecommunications

BY SCOTT KIRSNER

IT'S AN OFTEN-TOLD JOKE IN humor-deprived year 2000 circles: "If there's no power in January 2000, then nobody has a Y2K problem."

Unfortunately, it's true. Even the efforts of the most capable Y2K project team can be undermined by failures of the vital infrastructure—power, telecommunications and municipal services—that supports every business.

Early signs aren't good. A survey conducted in June by the U.S. Senate's Y2K committee found that only 20

percent of companies involved in power generation, transmission and distribution had completed an assessment of systems that could be affected by the millennium bug. Lou Marcoccio, Y2K research director at Stamford, Conn.-based GartnerGroup Inc., expects at least one-third of all telecommunications companies to experience at least one failure of a mission-critical system, resulting in sporadic interruptions of service. He notes that while major telecommunications networks should operate

intact, some niche services are likely to be interrupted.

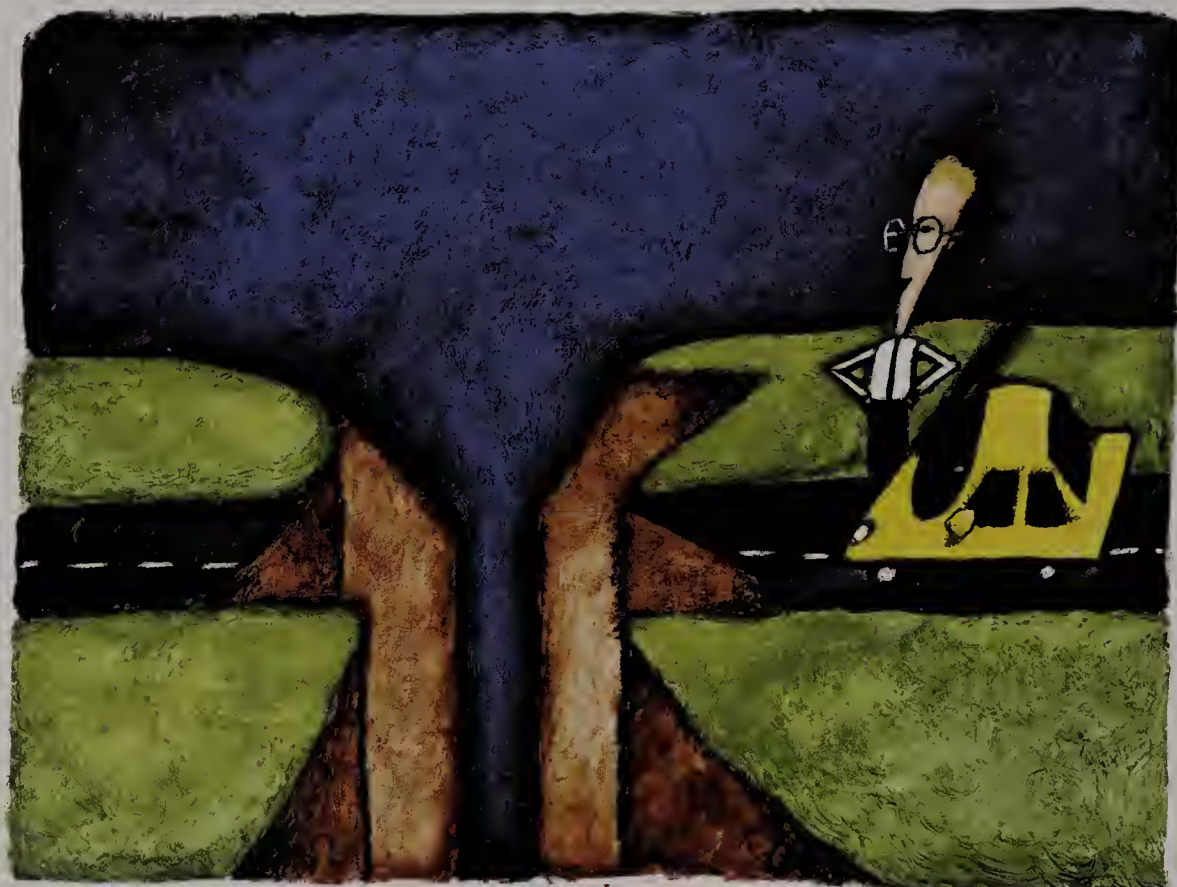
The outlook is even gloomier for city governments, which are responsible for water and sewage treatment as well as emergency services. "Awareness is low; they don't have the money or staffing to deal with this, and they can't afford to hire the big-name consultants that the Fortune 500 can hire," says Ian Hayes, president of Clarity Consulting Inc. in Hamilton, Mass., and co-author of *Year 2000 Software Crisis: The Continuing Challenge* (Prentice Hall Computer Books, 1998).

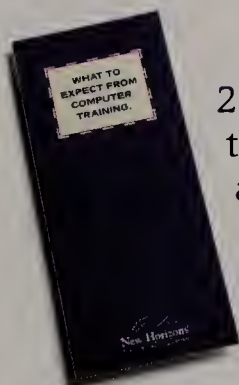
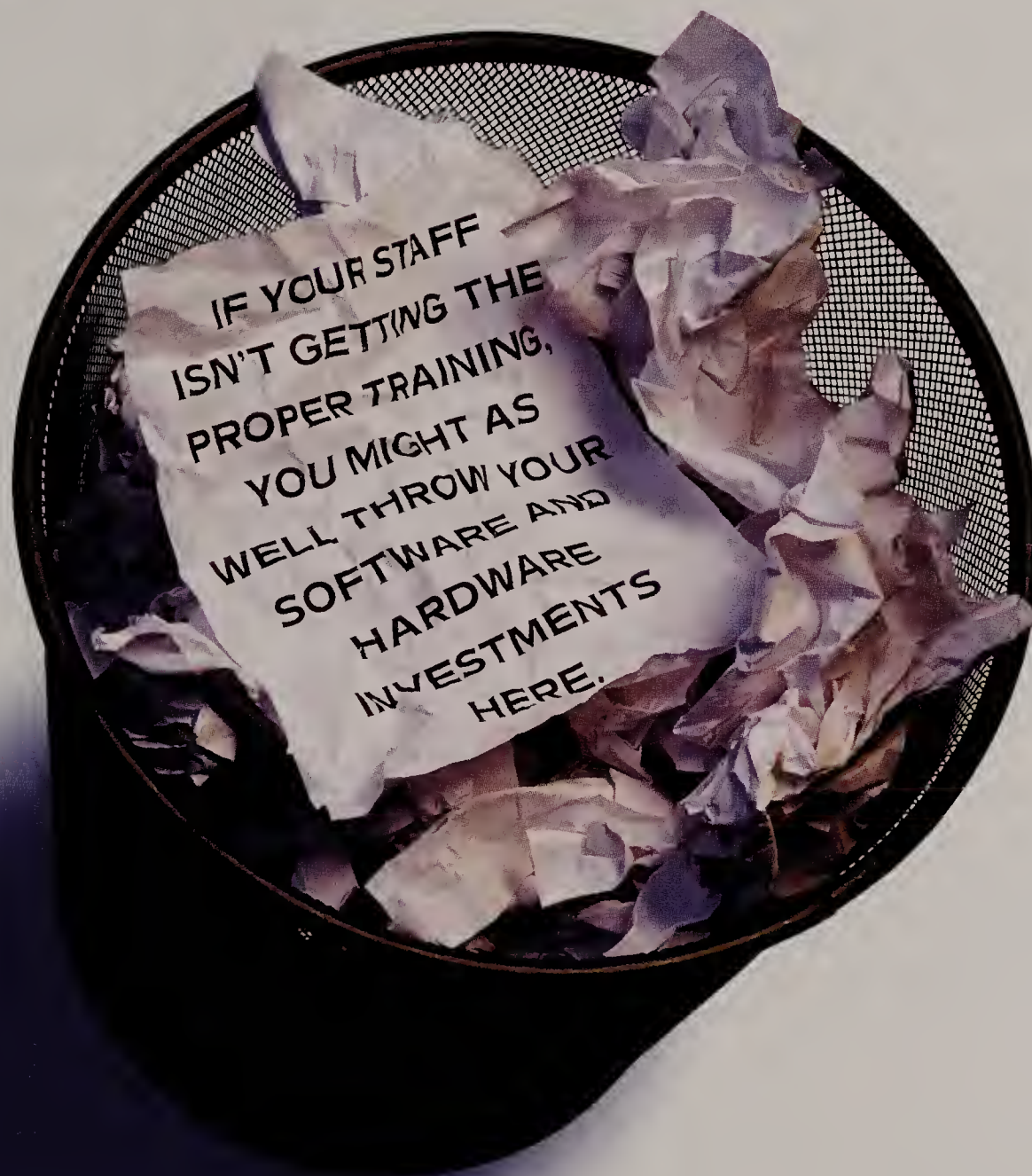
Infrastructure issues are extraordinarily difficult to grapple with. When working with a vendor to ensure that it's compliant, typically you have leverage: Your business is important to the vendor, and if it doesn't make sufficient progress on Y2K, you can always switch suppliers. That's not always the case with the local power company, and it's never the case with municipal governments, unless moving your business to another city is an option. Making certain that your infrastructure providers will survive the transition to 2000 requires thorough investigation, rigorous contingency planning and a dash of old-fashioned volunteerism.

Ask the Right Questions

It's easy to take basic infrastructure for granted, since we're so rarely deprived of it. That's why it's important to be comprehensive in identifying the services your business relies on. Are regular deliveries of heating oil important? Do the majority of your employees rely on public transportation to get to work? Do you distribute much of your product by rail? There are all sorts of services beyond power, water and dial tone that companies can't function without.

Once you've compiled and prioritized a list of infrastructure providers crucial to your business, it's time to launch an inquiry into the status of





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Year 2000 Challenge

their Y2K efforts. Even better than sending a survey or letter is a personal contact with someone on the company's project team; often your account representative can facilitate this or get the information you need—more than would be put in a letter.

Ed Yourdon, chairman of the Cutter Consortium, a research firm in Arlington, Mass., and co-author of *Time Bomb 2000: What the Year 2000 Crisis Means to You* (Prentice Hall Computer Books, 1998), suggests some questions to ask: "Are you Y2K-compliant today? When do you intend to be so?" If you're still dubious, you should ask what stage they're at and how many people they have working on the project."

director of Bell Atlantic's Y2K program office, says wryly.

When They Won't Talk

All three utility execs admit there are limits to the information they're permitted to give out and hint that bigger companies may have an easier time getting access than the small fry. "Most of the companies below the Fortune 500 can't get a straight answer from a utility," complains Yourdon.

If that's the case, there are solutions. Seek out information from the company's SEC filings and its Web site. If all else fails, you may want to try one of the "alternative" means of gathering intelligence proposed by Matthew Dusanic,

Contingency planning can also involve stockpiling raw materials in case transportation systems can't deliver them in January 2000, opening a dialogue with alternative telecommunications providers or simply mapping out the scenarios that would force you to shut your doors.

Lend a Hand

Many small and midsize municipalities are overmatched by the Y2K problems they face. Marcoccio at GartnerGroup estimates that while the dozen biggest cities in the United States have begun addressing their issues, few others have yet charted significant progress. "I think a lot of municipalities aren't paying attention to this yet," concedes Richard Hofland, year 2000 manager for the city of Portland, Ore. To remedy that, Hofland says businesses need to start waking up city officials.

But even when awakened, city governments are often short of resources. One solution, proposed by Hayes of Clarity Consulting, is volunteerism. "The problem is that cities don't have the staffing to do a thorough assessment, remediation and test phase," he says. So earlier this year, Hayes joined two other volunteers and introduced himself to the mayor of Beverly, Mass., where he lives, and offered to help conduct an audit. The mayor took him up on it. "In every case I'm aware of where people have volunteered, the government has been happy to have them," he says. Hayes also advises employers to give their Y2K staffers an occasional afternoon off to make presentations or assist with Y2K in nearby towns.

That kind of collaborative attitude should exist throughout a company's investigation of its infrastructure dependencies. "The more we can share, and the more we can learn, the better," says Keast at PG&E. And the more cooperation on infrastructure concerns that takes place over the coming 15 months, the less likely it will be anyone will wind up as the butt of the century's least-funny joke. **CIO**

Scott Kirsner, a Boston-based writer, is working on a series of articles for CIO on the Y2K problem. He can be reached at kirsner@worldnet.att.net.

"We've politely declined offers of weekly progress meetings." —Skip Patterson

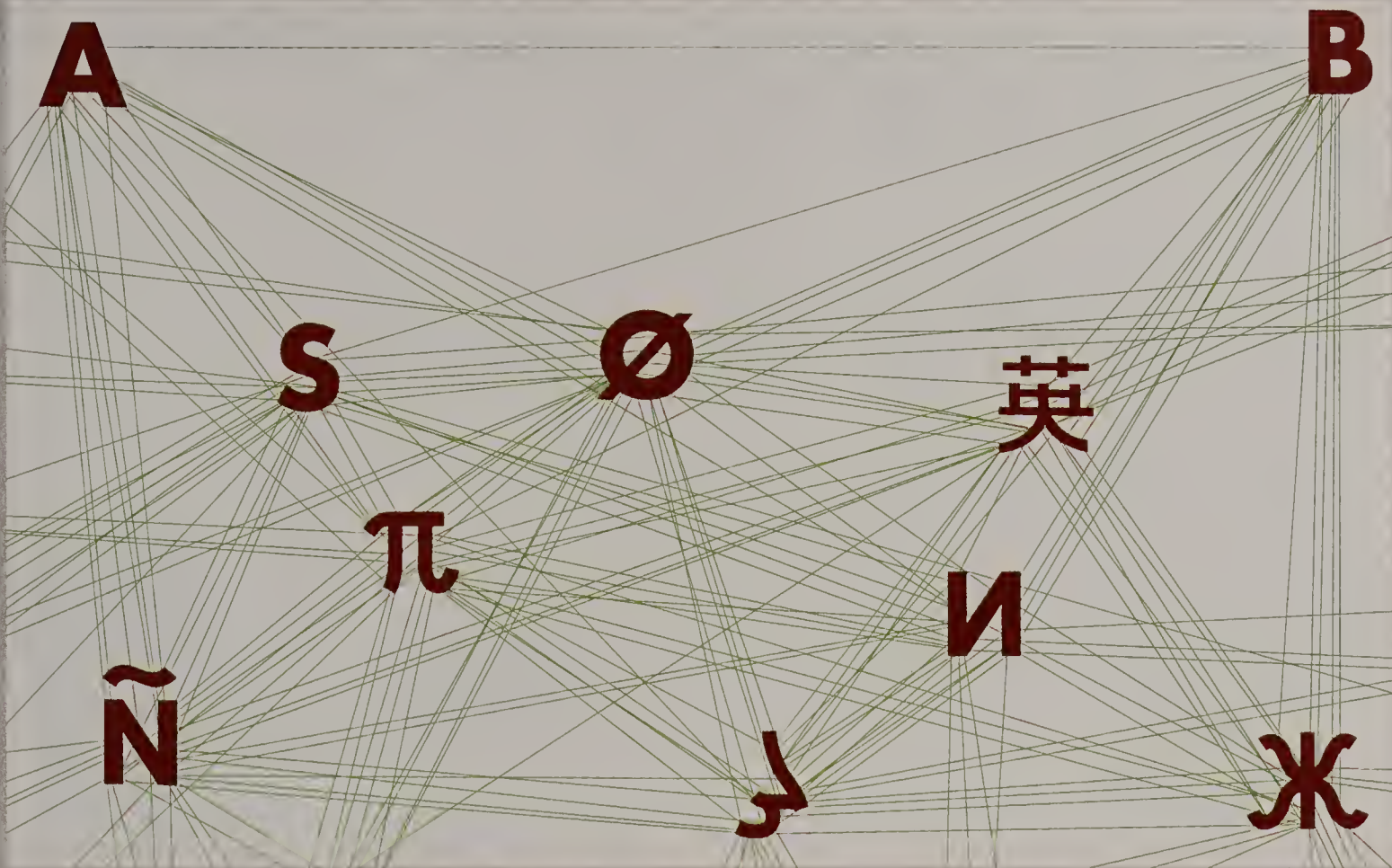
At Schneider National Inc., a transportation services company based in Green Bay, Wis., Y2K Project Manager Tom Kempen convened with operations executives and determined that telecommunications was one of his company's biggest infrastructure issues. "We handle 1.2 million calls a month from customers, and there's a strong feeling here that if we can maintain telephone contact with them, we'll be able to stay in business even if there are other kinds of failures," he says. As a result, he has spent a lot of time with the company's two telecommunications providers.

Telcos and other utilities say they're open to this kind of contact. "We're meeting all the requests for information that we receive," says Fred Kowitz, corporate Y2K director for Ameritech Corp. in Chicago. John Keast, vice president and CIO of PG&E Corp. in San Francisco, parent of the Pacific Gas & Electric Co. utility, welcomes questions from customers but says he hasn't seen as many inquiries as he expected. New York City-based Bell Atlantic Corp. has been holding ongoing seminars in five cities to highlight the company's Y2K progress and responding to thousands of inquiries. "About the only thing we've politely declined are the offers from customers to conduct weekly progress meetings with us," Skip Patterson, executive

principal and cofounder of Superior IS, a Houston consultancy. "Participating in local Y2K user groups is a good way to find out what's going on under the covers at your utility or telco," he says, noting that Y2K staffers from those companies often attend such meetings and talk about what they're doing.

It's not always end users who are seeking information from infrastructure providers, though. Power companies, for instance, need to understand their customers' plans for the switchover from 1999 to 2000, says Charlie Siebenthal, manager of Y2K programs at the Electric Power Research Institute (EPRI), a global energy consortium based in Palo Alto, Calif., that serves utilities. "If a number of big customers are going to shut down their plants over the holidays and then restart them, we need to know that," he says. "Having to deal with fluctuations in demand and our own Y2K issues could be too much."

Crafting contingency plans around infrastructure failures presents a host of challenges. The lack of an alternative supplier is foremost among them. But that doesn't mean planning can't be effective; most experts don't expect complete loss of power or dial tone as a result of Y2K, and so the issue at hand may be simply preparing for temporary outages or reductions in the quality of service.



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Edited by Howard Baldwin

In Search of Multimedia

As more corporate information is stored as audio and video files, users want more immediate access to it. New indexing tools tackle the problem.

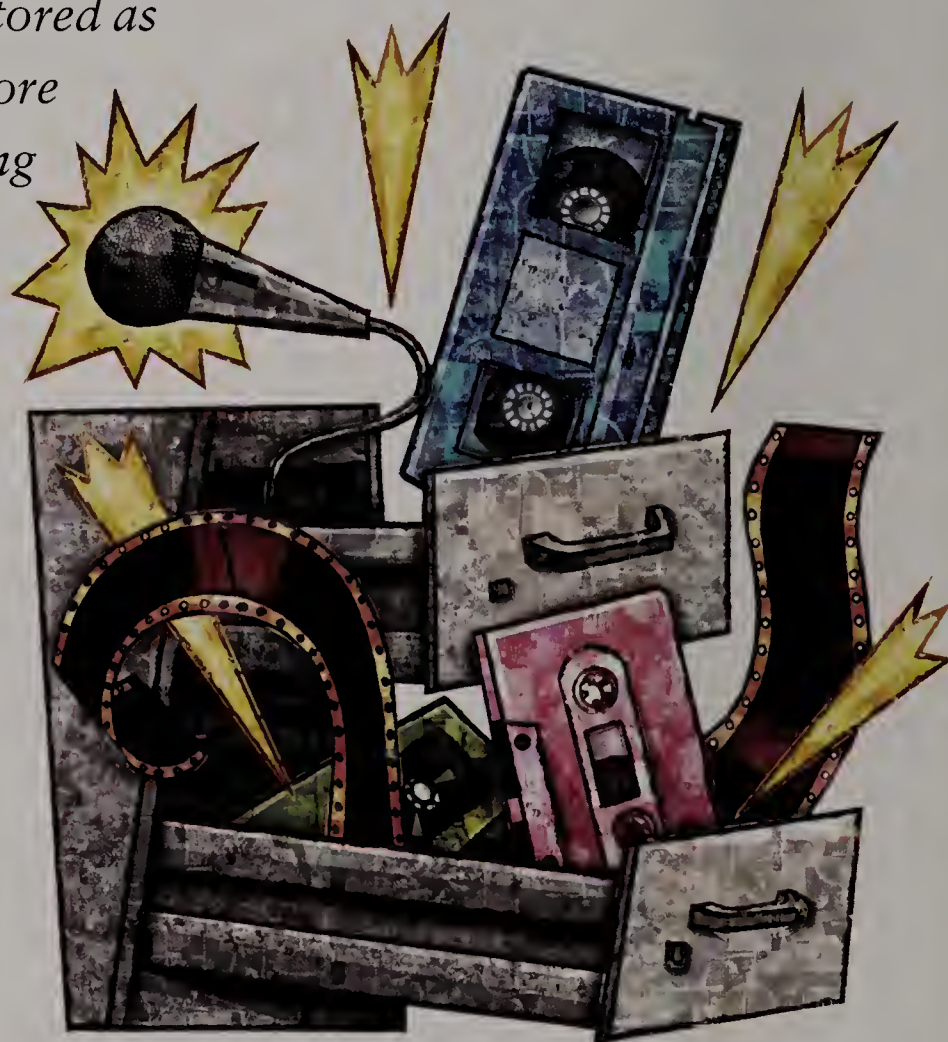
BY KIMBERLY PATCH
AND ERIC SMALLEY

IS YOUR I.T. STAFF BEING ASKED TO BECOME the corporate pack rat, storing tapes of seminars and videos of presentations, because you never know when someone will want it? It's easier than ever before, with the price of storage as low as it is, but before IT can deliver, users have to be able to find what they're looking for. And that means being able to search for a video clip as easily as a text file.

Text search engines have been around for decades, and image processing technology has been available for years. But how do you search through something that changes 30 times a second? The key is indexing each audio or video file as a collection of smaller segments and providing pointers to each segment. Then you simply search on the index.

So how do you create an index for, say, hundreds of hours worth of video without having your entire IT staff and half the monks in the Eastern Hemisphere do the job manually? Fortunately, an emerging class of software, provided by vendors in the burgeoning field of media asset management systems, automatically indexes audio and video information.

Automatic indexing software scans audio and video streams and creates searchable indices (as well as storyboard or thumbnail representations) of the streams' contents. Most products do this by exploiting as much metadata (information that describes the actual data) as possible. For audio and video, metadata includes time codes, transcripts,



closed-captioning and key framing. In key framing, the software scans for changes in the video signal caused by cuts, fades, wipes and other production cues, then takes a "snapshot" of the new frame to serve as the "key" to that segment of the video.

Companies that offer automatic video and audio indexing products include The Bulldog Group Inc. of Toronto, Excalibur Technologies Corp. of Vienna, Va., IBM Corp. of Armonk, N.Y., Magnifi Inc. of Cupertino, Calif., and Virage Inc. of San Mateo, Calif.

Some of these companies have applied rudimentary content-processing techniques: Bulldog uses technology that analyzes sound from audio streams to distinguish among speech, music and applause and determines coarse changes in volume. Virage offers media cataloguing and analysis products such as its Video Cataloguer, which uses advanced media analysis algorithms to extract metadata from video. IBM's Query By Image Content (QBIC) technology recognizes changes

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in color and texture. All work with a range of back-end database systems, including Oracle and Informix; IBM also sells an end-to-end solution that incorporates its DB/2 database. All of the products are components of or add-on modules to the companies' media management software suites. Prices for the full suites reach \$25,000.

Instant Replay

SportsLine USA Inc. of Fort Lauderdale, Fla., uses Magnifi's Enterprise Server to automatically index sports video clips and other content the company makes available on the CBS SportsLine Web site. Sports fans can perform a keyword search and then view thumbnails of matching video clips.

The Magnifi software has the capability to index new content within an hour of its posting to the Web site and reindex the entire site twice a week, depending on the way each company chooses to implement it, says Dan Leichtenschlag, chief technology officer for SportsLine. Given the large amount of data involved and quick turnover of the site's content, rapid indexing is necessary to make sure the bulk of the content is searchable at any given time.

The Magnifi software "makes us money," says Leichtenschlag. The equation is simple: Easier searching means people access the site more and view more pages, which means more impressions to report to advertisers.

Using metadata for video indexing is adequate for making video clips searchable on the company's Web site, but automatic video content processing will be a welcome addition, Leichtenschlag says. With such a service, users would be able to find clips of skiing events by keying in a word like "mountain" and the software would find sports clips that include mountain landscapes. Audio content processing is an even more pressing need because the company produces a syndicated radio show and generates lots of audio material, he adds.

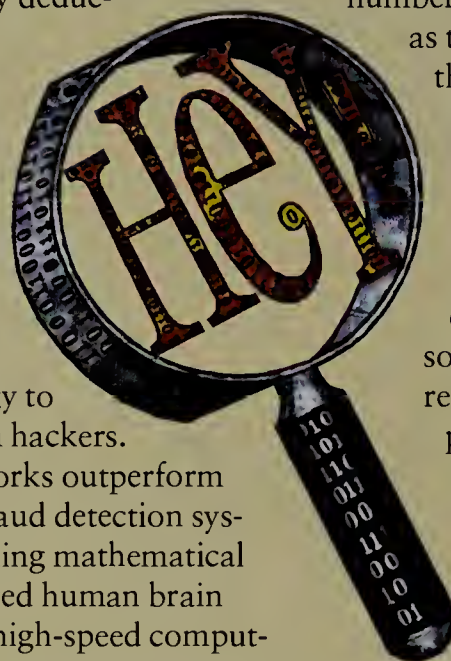
The problem facing PBS Video, which sells PBS's archive of American history programming to schools, is how to let its customers search 300 hours of video to choose what they want to use. The

Sic 'Em, Boy

Neural networks ferret out hackers

SHERLOCK HOLMES thwarted criminals by using cool, steady deduction. More recently, CIOs and telecommunications managers have begun to rely on the logical power of neural network technology to combat telecom hackers.

Neural networks outperform conventional fraud detection systems by combining mathematical models of selected human brain functions with high-speed computing capabilities, says Leon Cooper,



ber of calls placed to or from a certain phone, or to certain billing numbers, as well as such factors as the duration of calls and the days and times the calls were made," he explains.

Nortel's Harlow, England-based fraud solutions unit tapped neural network technology for its SuperSleuth software, which was released this spring. The product, which combines neural network software with traditional rules-based detection, scans call records in near real-time and alerts analysts whenever it

detects calling patterns that may be the work of hackers. The product doesn't require users to establish special benchmark parameters, such as the number of international calls made during a particular time period or the value or duration of calls. SuperSleuth's accuracy actually improves over time, as human operators confirm fraud incidents detected by the system.

Bill Seymour, the unit's general manager, describes SuperSleuth as the next big step in the fight against telecom fraud. "Because neural networks learn quickly and are adaptive, they are highly effective at identifying fraud in situations where calling patterns change rapidly, such as in the cellular industry."

While neural networks are proving to be an effective fraud-busting tool, Cooper acknowledges that the technology remains something of a dark science. "Sometimes there simply are no patterns, and in such cases there's nothing a neural network can do. Still, using the technology gives users a much better chance of detecting fraud than throwing darts."

— John Edwards

FINDING FIENDS

co-chairman of the board of Nestor Inc., a Providence, R.I., company that develops intelligent systems. Cooper, a 1972 Nobel laureate for his work in theoretical physics, says neural networks help discover hackers' handiwork by uncovering the unusual calling patterns they typically leave in their wake. "These patterns are often very abstract, undetectable by humans. But a neural network doesn't care—it will find the pattern with no difficulty as long as it has the right information fed in," says Cooper. Then it will remember the pattern for future comparisons, essentially 'learning' its way toward higher intelligence.

"A neural network takes many call records and flags those calls that have a high probability of being fraudulent," says Todd Gutschow, vice president of technology and new markets at HNC Software Inc., a San Diego company that provides neural network fraud detection tools to telecom and credit card companies. "The neural network looks at the num-

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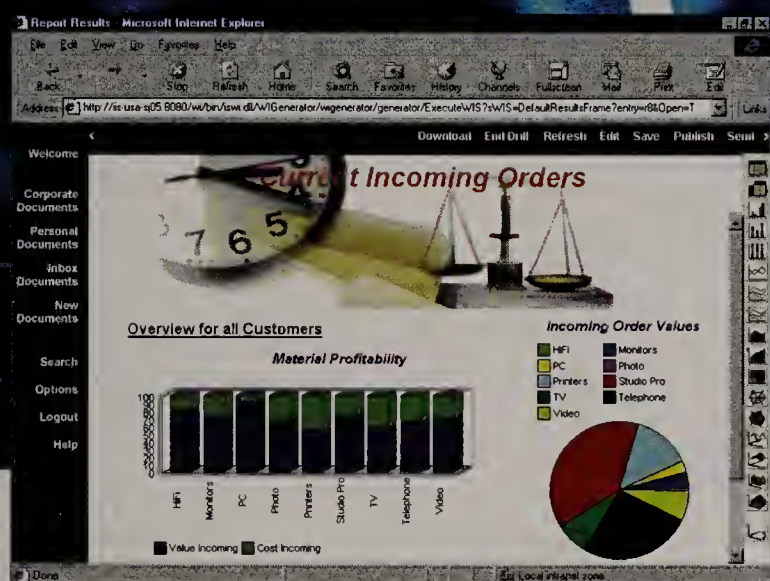
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short-term fix has been a manually created paper index—a big loose-leaf binder that teachers go through to find the right tape and where in the tape to find the sequence they need. But creating and updating the binder is an expensive process that leaves customers with a less-than-satisfactory experience.

To remedy the situation, PBS Video is deploying Screening Room from Excalibur. The system, currently in beta testing, automatically links users to the PBS Web site. It allows PBS to provide a more robust and up-to-date index with links to further information, and it adds synchronized online transcripts and chapter and program information to the index so teachers can print portions that accompany specific video segments, says Eric L. Sass, senior vice president of PBS Learning Media.

The abilities afforded by automatic audio and video indexing can also help users sidestep cost issues. Analog media in a digital world usually has negative value, says Michael Moon, president of Gistics Inc., an economic research and executive education firm based in Larkspur, Calif. “You’ll spend far more money trying to digitize it and manage it than it could possibly ever produce in terms of cost savings, quality improvements, time-to-market improvements or any sort of asset valuation,” he says.

This equation changes drastically, however, when the audio and video material is digital from the get-go, Moon notes. Analog audio and video can be recorded and played back only on VCRs and audio tape recorders. But digital audio and video can be stored and played back on computers, which means it can be made available online. And as more information becomes available online, audio and video indexing will become much more important. Digital audio and video is also easier to index because the metadata is easier to access.

This is not to say that organizations should never apply audio and video indexing to analog media. Companies will generally realize ROI by creating digital indices for large, offline storage systems, such as archives of analog video tapes, according to Moon. The cost of indexing the archive is relatively low, especially compared with the cost of digitizing or otherwise modifying the archive itself. Though the content of the archive remains offline, the digital index makes it easier to access materials in the archive.

There is little reason to hold off deploying an audio and video indexing system for heavily used material. After all, here’s a tool that creates a card catalog for your enterprise’s audio and video data and integrates it with the databases and search engines your users and IT staff are already familiar with. If the audio and video data on your system looks like the final scenes of *Citizen Kane* or *Raiders of the Lost Ark*, a \$50,000 investment to make it accessible and useful justifies the costs you incurred collecting it in the first place. And because most of the products on the market are modular and work with a variety of search engines and databases, your investment in audio and video indexing is relatively safe.

“What we’ve tried to do is provide a very low-risk entry

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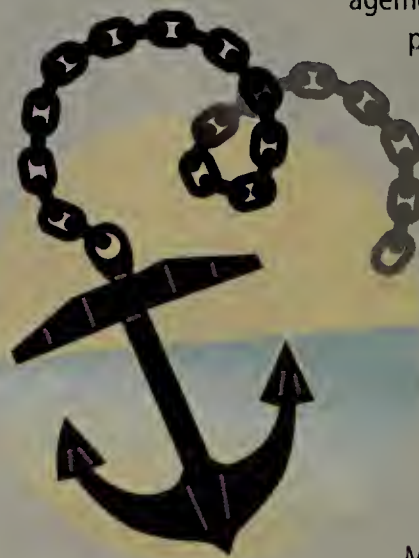
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point for people to begin indexing the media,” says Bradley Horowitz, founder and chief technologist of Virage. “We’re at the front end of whatever you want to do with the media downstream. You can actually change back-end strategies mid-stream and not have to go through the process of re-indexing.”

The same is true for the media. Video will likely migrate to DVD and, as server processing power and network bandwidth increase, to video-on-demand systems (see “Moving Pictures Go to Work,” *CIO* Section 1, June 15, 1998). Once you have an index in place, your content remains searchable regardless of medium or format.

What's Next?

All those RealAudio files filling up corporate disk drives are a natural fit for automatic indexing. Speech recognition technology will allow indexing software to translate spoken audio to text. For example, the technology would allow you to find the speech your boss gave last year by using keywords like “first quarter 97 sales forecast.”

These new indexing capabilities will be particularly helpful for indexing corporate video because the typical CEO’s stockholder meeting speech does not include closed-captioning and has few, if any, production cues. But it does have a soundtrack. Today’s speech recognition technology has a relatively high level of accuracy for single users who have trained the systems but loses accuracy with multiple untrained, recorded voices.

The indexing application, however, doesn’t need 100 percent accuracy, says Horowitz. “If in a two-minute clip of video [it] only recognizes a half-dozen words, maybe ‘Clinton,’ ‘Lewinsky,’ ‘testimony’ and ‘guilty,’ those are all [it] needs to provide handles into the video.” Several vendors, including Virage, are scheduled to add real-time speech recognition technology this fall.

The holy grail of video indexing is true video content recognition that distinguishes among a wide range of objects. Though rudimentary shape recognition algorithms exist, useful object recognition technology is years, if not decades, away. The standard approach to object recognition is to model specific objects—an enormous undertaking considering the near infinite number of objects and multiple renderings of individual objects.

An alternative type of technology, pattern recognition, may get you there sooner. Although it’s not yet available as an application, Chroma Graphics Inc. has demonstrated an image recognition technology that learns by example instead of requiring programming for each type of object. If you want to search a video for, say, apples, you feed the program several images of apples. And like a child realizing that the crunchy fruit in front of her and the picture in the book she holds are both apples, the program learns to recognize apples beyond the examples it’s shown. **CIO**

Kimberly Patch and Eric Smalley are freelance writers in Boston. They can be reached at kpach@scriven.com and esmalley@scriven.com.

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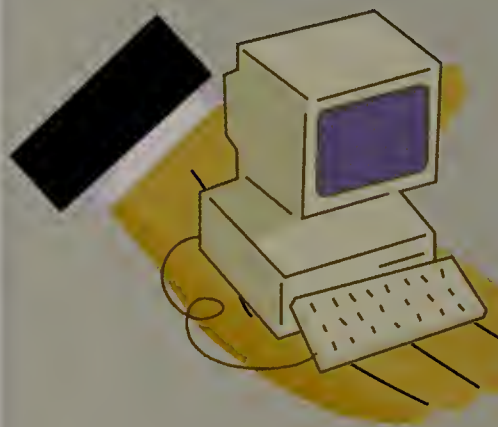
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Windows-like applications; it then installs them on a Web server. The handhelds access the Web server via modems or wireless connections. Pricing for the development software starts at \$50,000. For more information, call 914 631-5365 or visit www.clientsoft.com.



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According to the company, Harmony will leverage the investment companies have in their ERP systems by extracting and analyzing data and comparing it to internal objectives, competitive benchmarks and industry-specific practices. The Harmony suite includes a data mart repository and a group of industry-specific modules. The data mart and metrics for supply chain and demand chain metrics are scheduled to be available by press time, while the operational-financial metrics will be available this fall. For more information, call 650 696-9580 or visit www.vhq.com.

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INDEX

Page numbers refer to the first page of the article(s) in which the company is mentioned. This index is provided as a service to readers. The publisher does not assume any liability for errors or omissions.

Company Index

Advanced Technology Staffing Inc.	32
Ag Decisions Inc.	46
Agri-Tech Solutions	46
Agronomy Service Bureau LLC	46
American Home Products Corp.	46
American Institute of Certified Public Accountants	18
Ameritech Corp.	66
Apple Computer Inc.	28
Arthur Andersen LLP	46
AT&T Corp.	58
BankBoston N.A.	28
Bell Atlantic Corp.	66
BowWow House	18
Bulldog Group Inc., The	70
Cendant Corp.	18
Center for Workforce Effectiveness	32
Chroma Graphics Inc.	70
Clarity Consulting Inc.	66
ClientSoft Inc.	70
Computer Sciences Corp.	46
Cutter Consortium	66
Edmark Corp.	18
Electric Power Research Institute (EPRI)	66
Ernst & Young LLP	70
Excalibur Technologies Corp.	70
Forrester Research Inc.	32
GartnerGroup Inc.	66
Gistics Inc.	70
Harmony Software Inc.	70
HNC Software Inc.	70
Honeywell Inc.	32
IBM Corp.	18, 32, 70
IDG Research Services Group	58
Integrated Design Inc.	10
Ivans Inc.	18
Know It All Inc.	18
Knowledge Adventure Inc.	18
KPMG Peat Marwick LLP	70
Learning Co., The	18
Little Tikes	18
Lucent Technologies Inc.	18
Magnifi Inc.	70
Microsoft Corp.	58
Monsanto Co.	46
Motorola Inc.	58
Nestor Inc.	70
Nivel Partners Inc.	32
Nortel	70
Northwest Natural Gas Co.	32
Oakand Group	32
P.C. Data Inc.	18
Pacific Gas & Electric Co.	66
Panda Software International	70
Penn Mutual Insurance Co.	10
PG&E Corp.	32, 66
Prudential Insurance Co. of America, The	10
Resource and Land Management Inc.	46

Revive Technologies Inc.	18
Rubbermaid Inc.	18
Schneider National Inc.	66
Site Specific Management Co.	46
SportsLine USA Inc.	70
Superior IS	66
Toyota Motor Sales, USA Inc.	18
Union Pacific Railroad Co.	58
Virage Inc.	70
Walt Disney Co., The	58
Webbridge Inc.	70

Advertiser Index

*Denotes Section 2 Advertisers

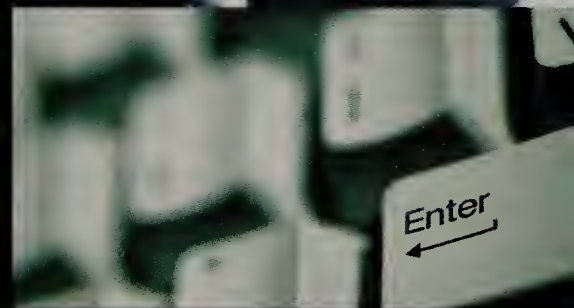
Axiom Corp.	2
Amdahl Corp.	C3
American Power Conversion	5*
Aonix	35*
Best! Software	17*
BMC Software	41*
Business Objects Inc.	29*, 73
Cabletron Systems Inc.	31*
Candle Corp.	48
CAP Gemini America Inc.	63
CEMA	C3*
CIO Communications Inc.	21*, 39, 67*, 69*, 71*
Cisco Systems Inc.	19
Comdex	73*
Computer Associates Intl. Inc.	C2*, 5, 13*
Compuware Corp.	27
Datalink	77
Dell Computer Corp.	C2
DLTape Systems	25
Dow Jones & Co.	9*, 29
Dun & Bradstreet Software	71
Empirical Software	15*
Ernst & Young LLP	69
ETI	57*
Exabyte Corp.	15
Gateway 2000	8
Hewlett Packard Co.	31
IBM Corp.	C4*, 6*, 25*, 49*, 53, 55
Inacom Corp.	22
Intel Corp.	40
Intelispan	75
Intersolv	62*
JD Edwards & Co.	11*
Kingston Technology	C4
Lockheed Martin Corp.	3*
Lotus Development Corp.	35
Mercury Interactive	27*
MKS Inc.	65*
Modcomp	55*
Netscape Communications Corp.	13
New Horizons Computer Learning Centers	67
Novell Inc.	16
Oracle Corp.	7
Peregrine Systems	20A*
Platinum Technology	37
Primeon	79
Remedy Corp.	51*
SAP America Inc.	39*
SAS Institute Inc.	21
Segue Software	61*
Sybase Inc.	65
Tivoli Systems Inc.	36*
Unisys Corp.	11
US West (Regional)	39
USWeb Corp.	43*
UUNET	19*
VisionTek	43
Wang Laboratories Inc.	45

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ShopTalk

The Metropolitan Museum of Art's Arthur Tisi on Creating a Web Presence

CIO: How long has the Met had a Web site?

We established the first generation of our Web site about three years ago. We've been doing e-commerce from day one, selling museum merchandise, posters, jewelry reproductions and the like. In that time, our volume has increased each month. And though I don't want to get into numbers, I can conservatively say that online commerce revenues have doubled since the same time last year.

Has the growing online business created conflicts among the Met's more traditional retail channels?

I don't think there's channel conflict. For one thing, we're inclusive in terms of the Web site task force. We have members from both the curatorial and administrative sides of the museum. That helps us look at the Web activities as additive. We don't see the Web as diminishing another revenue stream because at this point our Web customers represent a different demographic. We have an Internet



Spotlight On:

Arthur Tisi, CIO, The Metropolitan Museum of Modern Art, New York City

- **Line of Business** Museum, retailing and education
- **Bio** Has been CIO at the museum since 1993; prior to that, was CIO at the National League for Health Care in New York City
- **Day to Day** Assists the with strategic goals and applies technology to support the museum's mission
- **Challenges** Working on Y2K compliance, managing the redesign and ROI of the Web site (www.metmuseum.org) and further integrating technology into the museum's processes

membership category called Met Net that offers particular advantages to people who join over the Web. We recognize that we're going after a different individual.

How do you promote your brand through the Web?

Just like the New York Yankees evoke a sense of being the best baseball team, we want to present the Met as the greatest museum in the world. And we want to incorporate the essence of what makes the Met great on our Web site. The content, including the merchandise, information about the art collection, our wonderful membership organization and the educational opportunities, needs to reflect the museum itself.

What's the best way to create a Web-based branding program?

We want to replicate our

nology. It's a mistake for organizations to try to become something especially for the Web.

As a cultural institution that seeks members and engages in fund-raising, does the Met profile Web site visitors?

We know where people come from and which pages are served up the most, but we're not doing profiling now. Each organization has to make its own decisions about profiling. If [an organization] decides to do it, it needs to be prepared to disclose what it does, delete

historical information about people who make that request and accommodate people who don't want to be profiled.

Are there conflicts between IT and marketing as to who "owns" the Web site?

We haven't labored over who owns what exactly. The goal is to have everyone in each area of expertise make the site as good as it can be. The design of the site is up to the museum's design department. The technology is up to the IT people. Every department in the museum contributes. The IT department doesn't own the desktops in people's offices. In the same way, the Web site is a tool that extends empowerment through an organization.

—Megan Santosus

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